Financial and Operational Performance of Privatized Cement Industrial Units of Pakistan

Yaseen Ghulam

Portsmouth Business School
Economics and Finance Subject Group
University of Portsmouth

Thesis Submitted in Fulfilment of the Requirements of the Degree of Doctor of Philosophy

October 2012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

APCMA	All Pakistan Cement Manufacturer Association
GFCF	Gross Fixed Capital Formation
GOP	Government of Pakistan
NPM	Net Profit Margin
ROA	Return on Assets
ROE	Return on Equity
SF	Stochastic Frontier
SCCP	State Cement Corporation of Pakistan

ACKNOWLEDGEMENTS

It was 1996 in Pakistan, when I was first introduced to my M.Phil supervisor Dr Zareen F. Naqvi who encouraged me and provided intellectual input to carry out research that would inform policy makers in decision making. Those were the early days of Pakistani privatization programs. Since then, lot of studies had been conducted to evaluate the effectiveness of reforms agenda all across the world. I always wanted to contribute toward this debate. I hope this study contributes to existing literature on evaluation of policy reforms.

I would like to thank my supervisor Professor Shabbar Jaffry who kept this research agenda firmly on the scene. I would like to thank him for all his help in the process of getting things going and intellectual input. Shabbar, you are a great person.

Few people and institutions that helped me in collecting data for this study also deserve mentioning. These include Mr Ajmal Sharif, library staff from Karachi Stock Exchange, and officials from the 'All Pakistan Cement Manufacturer Association'.

Thanks to my wife Kiran Yaseen for understanding and encouragement. I was not able to spend time with my kids Areesha Yaseen and Zain Yaseen during the time when I was working on this study. Thank you kids, for making sure that daddy finish this study on time.

STATEMENT OF ORIGINALITY

"Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award."

……………………………… ...………..…..…………..

Signed Date

Yaseen Ghulam

ABSTRACT

In 1978, Government of Pakistan had taken a first step towards the privatization in Pakistan when three nationalized industrial units were handed over to their original owners. In the mid-eighties, privatization began to receive some consideration. A serious attempt in this regard however, was taken during early 1990s, when the government persuaded outright sale of public enterprises, nationalized commercial banks and development financial institutions. This study looks into the financial and economic consequences of transfer of ownership from public to private in the cement industry. The study utilizes the data on twenty cement firms covering 95% of the industry over twenty six years (1986 to 2011), comprising of both public and private ownership periods.

The study utilizes two different techniques; 1) financial performance evaluation using financial ratio analysis such as profitability ratios, operating efficiency ratios, capital investment, output, financial insolvency, and dividend pay-out pattern; 2) economic performance evaluation using adjusted economic ratios such as public profit and profitability and total factor productivity. By using frontier production and cost function, firm level cost and technical efficiency and productivity is estimated to compare the performance over the years. Total factor productivity is further decomposed into technical change and scale component to find out the key sources of productivity change. To shed some light on the labour use efficiency, the study estimated labour demand function using non-linear least square method. To complete the story, an effort was made to estimate competitive conditions in pre- and post

deregulation and privatization period using a variety of parametric and non-parametric methods.

It is found that on average, investment spending and output has increased after privatization. Margin on sales and other profitability measures show a jump immediately after privatization but had been falling recently. Overall, profitability levels have suffered due to bad economic and law and order conditions. Public profits and profitability has also improved over the years. The decomposition into cost and technical efficiency reveals that firm-level cost efficiency has improved in the post privatization period. It is also found that firms using dry production process are more efficient both technically and cost wise compared to firms using wet process. When firms are grouped according to location, the north region firms outperformed the south region firms in term of technical as well as cost efficiency. Further, contrary to expectations, labour demand function estimates show decreasing labour use efficiencies.

For most of the years this study covers, industry was operating under increasing returns to scale. The estimates of total productivity reveal that the industry has become more productive since 1997, recording 3-4% growth per annum. This growth was achieved primarily, due to technical change after significant investment was made by the new management in technology upgrades. The contribution of scale component was negligible. The evaluation of competitive conditions reveals that the industry as a whole has started exercising some market power in the post reforms period. By estimating biases in input usage, the study concludes that firms are using more labour and capital and less of fuel and material.

CHAPTER 1

Introduction

The main purpose of this chapter is to discuss the objectives, process and critical issues related to change of ownership from public to private sector (privatization). In doing so, this chapter will summarize the main findings of the existing literature on the issue of privatization and performance of firms in pre- and post privatization period. Critical issues not addressed in the available literature are highlighted and a summary is provided in term of the way this study has addressed these gaps. In subsequent analysis, the thesis will provide the summary of what is included in the various chapters to put the detailed analysis of the change in policy and subsequent performance of privatized firms into perspective. Last part is comprised of short summary of the layout of the study and the contribution of this study towards existing empirical literature on the issue of privatization and firms' performance.

1.1. Introduction

Cement industry in Pakistan has undergone significant changes in recent years as a result of deregulation and privatization of state owned firms in 1991-92. The process of deregulation started in the early 1980's, when the government began encouraging private sector investment to supplement the development programme of the state run State Cement Corporation of Pakistan (SCCP). Since the mass privatization of manufacturing and financial firms, all the cement plants in the public sector have now been transferred from SCCP to the private owners. In a new institutional set-up, public sector has no share as against to 85% before privatization. Pakistan has become 5th largest exporter of cement in the world, provides employment to 250,000 workers (directly and indirectly), and the "All Pakistan Cement Manufacturers Association" (APCMA) estimates the contribution of the industry towards the national kitty in the tune of 30 billion Pakistani Rupees (Pak. Rs.). Despite these developments, there are some serious allegations of the association forming a cartel and in effect replacing state monopoly. The APCMA however, maintains that the members' cooperation is aimed at adequate and fair supply of cement across the country.

This thesis compares the performance of two different ownerships regimes by using simple financial ratios to advanced economic assessment. Post privatization period performance is compared with the pre- privatization period. Privatized firms performance is also compared with the firms already working under private management structure. This provides an interesting case to see how change of ownership has affected firms' behaviour in term of setting prices, production levels and costs.

1.2. Aims and Objectives of the Thesis

Following a lead from the developed countries, a significant number of developing countries had implemented the privatization programme since the early 1980s. As a result, the ownership of a significant number of industrial units, financial institutions and utilities companies had been transferred to private sector worldwide. Broadly speaking, the aim of the programme has been to let the market economy function and to use the subsidies allocated to loss making public enterprises for the social sector in general and poverty reduction particularly. Boubakri *et al.* (2008) in regard to the objectives of privatization stated "primary aim is to reduce the role of the government as a dominant actor (stakeholder) in the economy and to favour the emergence of an active private sector".

Research on the success/failure of this change of policy has generated some interesting debate on the role of agency problems and the remedy by the change of ownerships. Despite of the huge efforts in comparing the performance of firms in pre- and post privatization scenarios, conclusions drawn from these studies are still not universal. Some early studies suggested performance under private ownership superior and supported the positive impact of privatization (some widely cited studies supporting this conclusion include: Thompson, 1987, Vickers and Yarrow ,1988, Bishop and Kay ,1989, Boardman and Vining ,1989, Megginson, Nash and van

Randenburgh ,1994, Galal *et al.* ,1994, Boycko *et al.* ,1995, Martin and Parker ,1995, Bhaskar and Khan ,1995, Barberis *et al.* ,1996, Bousoffiane *et al.* ,1997, Hart *et al.* ,1997, Newbery and Pollitt ,1997, Shliefer ,1998, Boubakri and Cosset ,1998, Scully ,1998, Plane ,1999, Claessens and Djankov ,1999, and D'Souza and Megginson ,1999). Others, including Fare et al. (1985), Atkinson and Halvorsen (1986), Kay and Thompson (1986), Sappington and Stiglitz (1987), Wortzel and Wortzel (1989), Tirole (1991), Laffont and Pint (1991), De Fraja (1993), and Willner (1996) support public ownership or at least do not consider public ownership as an impediment to the efficient operation.

Since 2000, by using relatively longer sample period, some more effort has gone on to evaluate the performance of firms in pre- and post privatization. This includes single as well as multi countries case studies. Similar to initial studies, literature seems to be not conclusive. Authors such as Shirley and Walsh (2000), Saal and Parker (2000), Megginson and Netter (2001), Rossi (2001), Chirwa (2001), Dewenter and Malatesta (2001), D'Souza *et al.* (2002), Jones and Mygind (2002), Estache *et al.* (2002), Djankov and Murrell (2002), Wei and Varela (2003), Sun and Tong (2003), Cullinane and Song (2003), Li and Xu (2004), Chirwa (2004), Brown *et al.* (2006), Okten (2006), and Amess and Roberts (2007) concluded that firms under private management performed better. Contrary to this, some studies such as Sall and Parker (2001), Saygili and Taymaz (2001) and Wang (2005) concluded differently.

Hence, it could be argued that although there is a vast body of literature on the public-private efficiency comparison and privatization effect itself, but it lacks the conclusiveness. There could be a variety of reasons for this including very short time span and sample used in the study, lack of comparable firms operating in a similar regulatory and economic environment and finally to greater extent use of inappropriate methodologies

Nonetheless, these mixed messages of the success/failure of the privatization programmes are adding fuel to uncertainty. One of the consequences of all this is that, governments in some developing counties, despite their utmost effort, had been unable to sell larger public sector corporations and utility companies. An update of the World Bank Group's Privatization Database shows that in 2008 privatizations in developing countries fell to US$38 billion, down 70 percent from 2007.

Despite Google scholar showing 379,000 documents on the keyword "privatization", there are however, remarkably few studies that looked into ex-post performance of the privatized industrial units in Pakistan. This has probably been due to lack of research culture and data availability issues. Further, this is also not surprising as Boubakri *et al.* (2008) while reviewing the performance of privatized firms in developing countries stated "In spite of the growing importance of the privatization phenomenon in developing countries, it is surprising that only a few studies have examined the impact of privatization on firm performance in these countries".

Notable among the studies in the context of Pakistani privatization are the studies by Aftab and Khan (1995) and Naqvi and Kemal (1997). Aftab and Khan found that private ownership resulted in less labour retrenchment. Contrary to this, Naqvi and Kemal concluded that the effect of privatization on efficiency, output and the price level was uncertain. But both of these studies lack rigmy and had used mostly financial ratios on selected number of firms. A primary aim of this study is to fill this gap and evaluate the effectiveness of change of ownership on the privatized firms' performance in term of financial performance, efficiency and productivity and test the level of competition.

1.2.1. Objectives of the Thesis

This study is the first comprehensive effort to evaluate the performance of the cement industry in Pakistan after privatization and broader reforms were introduced in 1990s. Broadly speaking, the thesis identifies two clear objectives.

Firstly, the objective of the study is to find out the financial performance of the industry and link this with the competitive conditions. The financial health of the industry is extremely important to make sure that the industry survives in the long run, continue contributing towards economy by paying maximum taxes and is able to compete well with international competitors. Abnormal and persistent higher profitability however, could be as a result of collusion rather than management efficiency. Recently, the APCMA offices had been raided twice by the Federal Investigation Agency (FIA) to find out the documentary evidence of cartel arrangement without any success. The allegation of manufacturer forming cartel could damage the repute of the industry which could jeopardize its long-term survival. By estimating the competition indices and linking with the profitability indicators, the study objective is to provide useful information to organizations such as the

"Competition Commission of Pakistan", the "Ministry of Industry", the "Industrial Development Board", the APCMA, media and the general public.

Secondly, as mentioned above, contrary to hundreds of studies on the issue of deregulation and its impact on performance of firms in developed world, there exists a serious gap in international literature on this issue for developing countries. One of the main objectives of this study is to fill this gap by carrying out a comprehensive analysis of qualitative changes, adjustments in input usage, social cost benefit analysis, labour use efficiency and productivity and technological developments in pre- and post reforms periods.

1.3. Layout of the Thesis

The thesis is comprised of eleven chapters in total. Next chapter ('Reforms and Cement Industry') is concerned with the rationale of privatization and deregulation policy, progress, issues and current state of play. This is followed by the discussion on the Pakistani cement industry including historical development, institutional set-up, pricing and distribution channels, and the technology of production of the cement industry.

Chapter 3 ('Choice of Performance Indicators') provides discussion on the ownership structures and performance. The chapter describes the basic questions related to the privatization policy, discussion of various performance indicators, competing methodologies, and their suitability for the comparison of two different ownership structures.

In chapter 4 ('Qualitative Assessment'), the thesis provides information on the qualitative and quantitative adjustments made as a result of change of ownership and their impact on the day to day running of the privatized firms and their competitors. The chapter sources information by looking at annual reports of the companies, interactions with the industry experts, producer association and consumers.

Chapter 5 ('Financial Performance') is devoted to the analysis of performance based upon purely financial indicators and proxies in pre- and post-privatization periods. Industry and individual firms' performance is assessed with the use of profitability, solvency and efficiency ratios. Simple and widely used non-parametric techniques are used to see any statistical difference in the value of these ratios in pre- and post privatization periods.

In chapter 6 (Social Cost Benefit Analysis'), the thesis deals with social cost-benefits analysis of the privatization policy. The discussion moves from pure private or corporate profit and profitability (chapter 5) to public profit or social profit/total return to capital and profitability. A link is established between private and social profitability and an effort is made to reconcile the difference in private and social profitability. Use of social profitability criteria is interesting and appealing given the fact that public firms' managers were less concerned with private profit and more focused on the maximization of social return. Thus by converting private profit to social profit, the study is able to make like for like comparison. This type of assessment was carried out in the initial years of post privatization (early and mid 1990s) in the studies sponsored by the World Bank.

Chapter 7 (‘Estimation of Efficiency and Productivity’) is comprised of modelling of technology of production. This chapter starts with the discussion of efficiency and productivity and then moves to estimation of technical and cost efficiency and total factor productivity. The objective of this assessment is to detect the key sources of changes in the productivity and efficiency by using parametric and non-parametric techniques. The study supplement pure parametric method of efficiency estimation with non-parametric linear programming based order-m efficiency techniques. Qualification to and explanation for the observed results are provided in this chapter.

Chapter 8 (‘Decomposition of Total Factor Productivity Change and Input Biases’) is continuation of the previous chapter where the thesis try to find sources of change in total factor productivity. Total factor productivity is decomposed into technical change and scale component. The study then establishes the substitution of factor inputs as a consequence of rising prices of energy and raw material in the post deregulation period after withdrawal of subsidies by the government. Returns to scale are calculated and interpreted for the overall industry and different ownerships (i.e. public, private and privatized) and size classes.

Chapter 9 (‘Labour Use Efficiency Estimation’) deals specifically with labour use efficiency and wage elasticities. The study models and estimates labour demand function by introducing risks in production process. Labour use efficiency score is calculated and interpreted in pre- and post privatization periods. Efficiency scores are modelled against a number of economic and company specific factors to detect the sources of labour efficiency.

Chapter 10 (‘Reforms and Competition in the Cement Industry’) is concerned with evaluation of competitive environment in the post reforms period. The chapter starts first with some simple indicators of competition such as herfindhal index and concentration ratios, and then, moves to more sophisticated statistical techniques. Different widely used and popular indices of competition such as λ, lerner index and Boone β are calculated and interpreted in this chapter. The chapter then discusses the implication of deviation from perfectively competitive market to monopoly or collusive behaviour.

In chapter 11 (‘Summary and Conclusion’), the study summarizes the findings, implications and limitations of the study with possible areas of improvements and extensions.

1.4. Originality and Contribution to Knowledge

The contribution of the thesis to the current field of knowledge can be identified in empirical grounds. Firstly, the studies that looked manufacturing sector performance and had captured long business cycles include Saygili and Taymaz (2001) [16 years], Chirwa (2004) [28 years], Bartel and Harrison (2005) [15 years] and Okten (2006) [17 years]. However, my sample period exceeds these studies with the exception of Chirwa (2004). Hence, this study provides perspective on the short as well as unique long-term effect of change of ownership on the firm behaviour and performance.

Secondly, broadly speaking, studies on the impact of privatisation on the performance of firms have used either financial ratios or estimation of efficiency and productivity by production and/or cost function. Studies using the first method include: Megginson *et al.* (1994), Villalonga 2000), Harper (2001), Boubakri and Cosset (2002), Jackson *et al.* (2003), Wei *et al.* (2003), Boubakri *et al.* (2004), D'Souzaa *et al.* (2005), Boubakri *et al.* (2005), Chen *et al.* (2006), Mathur and Banchuenvijit (2007), Farinós *et al.* (2007), Naceur *et al.* (2007), Cook and Uchida (2008), Huanga and Yao (2010), Huang and Wang (2011), and Zhang *et al.* (2012) . Financial ratios methodology is simple, intuitive and easy to implement but is less preferable among some applied researchers. This is due to being extremely simple, non-parametric nature and partial indicator of performance evaluation. Some studies that use advance techniques and estimate efficiency and/or productivity and compared firms performance in pre- and post reform regimes include: Saal and Parker (2000a), Rossi (2001), Sall and Parker (200b, 2001), Chirwa (2001), Estache *et al.* (2002), Jones and Mygind (2002), Resende and Faceanha (2002), Cullinane and Song (2003), Li and Xu (2004), Chirwa (2004), Tongzon and Heng (2005), Cullinane *et al.* (2005), Brown *et al.* (2006), Okten (2006), Amess and Roberts (2007), Sall *et al.* (2007) and Asaftei *et al.* (2008). Some authors such as Galal *et al.* (1994) used social cost benefit analysis to evaluate the impact of reforms on individual firms' performance.

To my knowledge, the analysis carried out in this thesis is more comprehensive and provides a complete picture in term of post reforms empirical performance analysis. The analysis starts from simple financial ratios, moves on to social cost benefit analysis and then extends to very sophisticated econometric estimation of production and cost function, competition indices and labour demand function.

Thirdly, the studies that addressed the issue of privatization/deregulation and firms performance since 2000 are either limited to developed countries such as UK with relatively stable political system, established property rights and good industrial base, BRICS countries (Brazil and countries related to former Russian block) or countries relatively at the advanced stage of their economic development (South Korea, Argentina, Turkey and Indonesia). Pakistan being underdeveloped, having extremely low per capita income, political instability (five times change of government since the first phase of the mass privatization programme) provides an interesting setting when it comes to analysis of the effect of change of ownership on firms' performance. This study could provide a nice benchmark for countries similar to Pakistan in term of nature of reforms, duration, types and economic development. Parts of the research output of this empirical investigation have been already submitted in leading academic journals and further submission are likely to be made soon.

CHAPTER 2

Reforms and Cement Industry

This chapter is concerned with rationale and politics of privatization and deregulation policy, progress, issues and current state of play. Subsequent analysis discusses the historical development, institutional set-up, market structure, pricing and distribution channels, technology of production, conditions of entry, demand and supply constraints and vertical integration of the Pakistan cement industry. Last section links cement industry activity with macro economy and government investment during the analysis period

2.1. Deregulation and Privatization in Pakistan

Similar to lot of other countries, Pakistani government used public sector as an engine of growth and the provider of employment during 1960s and 1970s. It was believed that government should invest in those industries where returns to capital are either low or gestation period is long. It was understood that the private sector would hesitate to invest in those industries and as a result economy would suffer in the long run. However, since the beginning of 1980s, situation, ideology and preferences changed and private sector started getting seal of approval as a driver of growth and facilitator of employment generation in Pakistan.

Privatization process in Pakistan started after the collapse of socialist system in Russia and its former allies as part of the larger economic reforms programme. The privatization programme was initiated to revive the struggling industrial sector and move towards market economy. The privatization and deregulation programme has been going through lot of ups and down ever since it was launched 40 years ago due to ideological differences and priorities of different governments. Table 2.1 summarizes the major events taking place since a serious effort was made to privatize industrial units, banks and utility companies.

The programme had also been under a fair bit of criticism. This includes unfair and unprofessional valuation of assets, favouritism, undue advantage to local bidders, no post privatization follow-ups and wealth accumulation by business tycoons and groups. Local business groups using political connections to get more detailed information regarding the financial health of the enterprises and outbidding the rival bidders has led to further accumulation of wealth in the hands of few oligarchs. The rise of a business group during the time of allegations of favouritism deserves some attention. Benazir Bhutto, the leader of the opposition in the parliament while addressing the parliament once summarised the allegation by saying "while one brother was selling, other was buying"

Table 2.1: Chronology of the Main Developments in the Privatization Process

Period	Main Events
Nov-90	Disinvestment and Denationalization Committee formed to identify enterprises to be listed for sale. This committee was also tasked to make recommendations for the mode of privatization.
Jan-91	Establishment of Privatization Commission (PC) to initiate and administer the privatization process. This involves valuation of enterprises by the independent consultants, initiate and executes bidding process, ensure and complete transfer of ownership to successful private bidder.
Sep-91	Sale of Allied Bank Limited to employee group
Oct-91	Govt reversed earlier decision of selling few selected enterprises and advertised 195 units for sale (fire sale!)
Nov-92	49 out of 195 units sold successfully to private investors and business groups. Remaining units were technically bankrupt and did not attracted interest
1994	Partial sale of PTCL
2002	United Bank Limited privatization to Abu Dhabi Group (UAE) and Bestway Group (UK) after lot of controversy over selling assets to foreigners
Feb-04	Handover of Habib Bank Limited management to Aga Khan Fund for Economic Development

Despite of these allegations, the programme continued over time and is likely to be revived again under the new government of Nawaz Sharif this year.

2.1.1. Rationale of Privatization

Contrary to western world, privatization in Pakistan was initiated not on the basis solid ideological grounds but rather it was the necessity of the time. By the end of 1980s, a significant number of firms in the public sector were making losses and as a result government fiscal space was getting gradually smaller due to increasing subsidies. This could be judged by the fact that by the end of 1987-88, the fiscal deficit reached to 8.5% of GDP. By getting rid of these loss making units, it was expected that the government would be able to use those subsidies allocated for these enterprises previously for the building of physical and social infrastructure[1]. As a result of selling public enterprises, it was believed that private owners would address the inefficiencies in the production and distribution process by reducing the number of political appointees' workers and sourcing the inputs from cost effective and reliable places[2]. It was also predicted that selling state owned firms to wider private investors

[1] By highlighting the trickle down effect of loss making and inefficient units on financial institutions, government finances, and the general public, the Privatization Commission of Pakistan added: "Many enterprises were kept afloat solely because of coerced lending from state-owned banks or government support via such means as equity injections, loans and bonds, budgetary subsidies, and explicit or implicit government guarantees. Such forms of government support were paid for by higher taxes on the people, whether they use these goods and services or not".

[2] The commission set up by the government to privatize the loss making units highlighted the role of agency problem by stating "As in many countries, decision makers and senior officials in SOEs often used the enterprises to further their vested interests. Staff and managers were often appointed with little regard to their appropriateness for the position. Prices for many goods and services were kept artificially low. Cross-subsidies and pricing inefficiencies became widespread, with many prices

would lead to greater level of competition and broader ownership through equity capital.

Considering the above mentioned objectives, the government put forward the following rationale of privatization of public enterprises[3]:

1. To reduce mismanagement and overstaffing in the state owned public enterprises (SOEs)
2. To improve production and profits thought to be well below potential
3. To encourage appropriate and cost effective investment

It was believed that by privatizing of these loss making units, government not only would be saving money in the form of reduction in subsidies, it would also send a single whereby private sector role in the development of business sector is recognized. The desire of the government in this regard was expressed eloquently by the Privatization Commission:

“The Government's policy of liberalisation and privatisation is aimed at promoting market-based, private sector-led growth. Privatisation would also send a strong signal to investors of the Government's faith in the private sector to generate economic growth and productive employment”.

---

bearing little relation to cost and a few interest groups benefiting from subsidies at the expense of the general public”.

[3] Source: Privatization Commission of Pakistan.

2.1.2. Modes of Privatisation

Similar to international practices and depending upon the nature of transaction, complexity of operations, strategic importance of entity to be sold, production and cost structures and perception about interest in buying the assets, following methods had been used by the Privatization Commission in selling of state-owned-enterprises, banks and development financial institutions.

1. sale of assets or business through competitive bidding (majority of the industrial units in early 1990s were sold by this method)
2. sale of shares through public auction or tender (known as a strategic sale when management transfer is involved)
3. public offering through a stock exchange usually a minority share (some public utilities share were sold by this method)
4. management or employee buyouts (some industrial units and financial institutions were sold using this mode)
5. lease, management or concession contracts
6. any other means as may be prescribed.

2.1.3. Privatization Process

Similar to other countries who privatized their state-owned enterprises, the Commission set up by the government adopted the set internationally recognized procedures including identification of asset (enterprise) to be privatized, hiring of financial advisors, doing a due diligence, valuation of assets, pre- bid qualification assessment, management of bidding process, transfer of ownership and post bid matters (see Flow chart 2.1 for detail). Depending on the nature of business and complexities, some variations in the procedure had been introduced by the Privatization Commission.

In an effort to make the process fair, the Privatization Commission in its mission statement stated:

"The Government is firmly committed to carrying out the privatisation in a fair and transparent manner. This includes ensuring a level playing field for existing and future entrants, protecting consumer and taxpayer interests, and dealing with public employees in a fair manner".

To ensure that as a result of privatization, market is not to become less competitive, the Privatization Commission was tasked through a legal ordinance to apply transparency in advertisement, bidding and transfer of ownership. The Commission in this regard states:

"In addition to specifying advertising requirements to ensure the widest possible participation in privatisation, the Ordinance directs the Privatisation Commission to advise that monopolies are not created in the privatisation process, to propose or strengthen a regulatory framework for independent and fair regulation, and to advise on deregulating the economy to the maximum extent possible"

Broadly speaking, following steps had been taken in the privatization process.

1. Identification

The initial task of the Privatization Commission is to identify the enterprise to be privatized considering the objectives and goals mentioned above. An advice is normally sought from the relevant ministry regarding issues and implications of selling the enterprise to private sector. The proposal forwarded then is to the Cabinet Committee on Privatization (CCOP), for a seal of approval as a potential entity for privatization.

2. Hiring of a Financial Advisor

This is one of the important task in getting the procedure right and to achieve best possible price of the public asset. The selection of financial advisor is normally performed by the transaction manager with the approval of the relevant board. After the new legislation in November 2001, the procedure has become more transparent in this regard.

3. Due Diligence

The financial advisor carries out the financial due diligence alongside legal and technical assessment of the transaction. This involves evaluating the legal issues that could arrive during or after the sale, assessing the condition of assets and a careful examination of financial accounts of the entity. After completion of these necessary tasks, the privatization plan in term of recommendations on restructuring (if needed), mode of sale etc. is prepared by the advisor.

4. Valuation of Property

This step involves putting the price tag on the entity to be privatized. Financial advisor or external firm specializing in the valuation of entities carries out the valuation and sets the reserve price of the entity using standard methods such as stock market valuation, discounted cash flow method or asset valuation at book or market value.

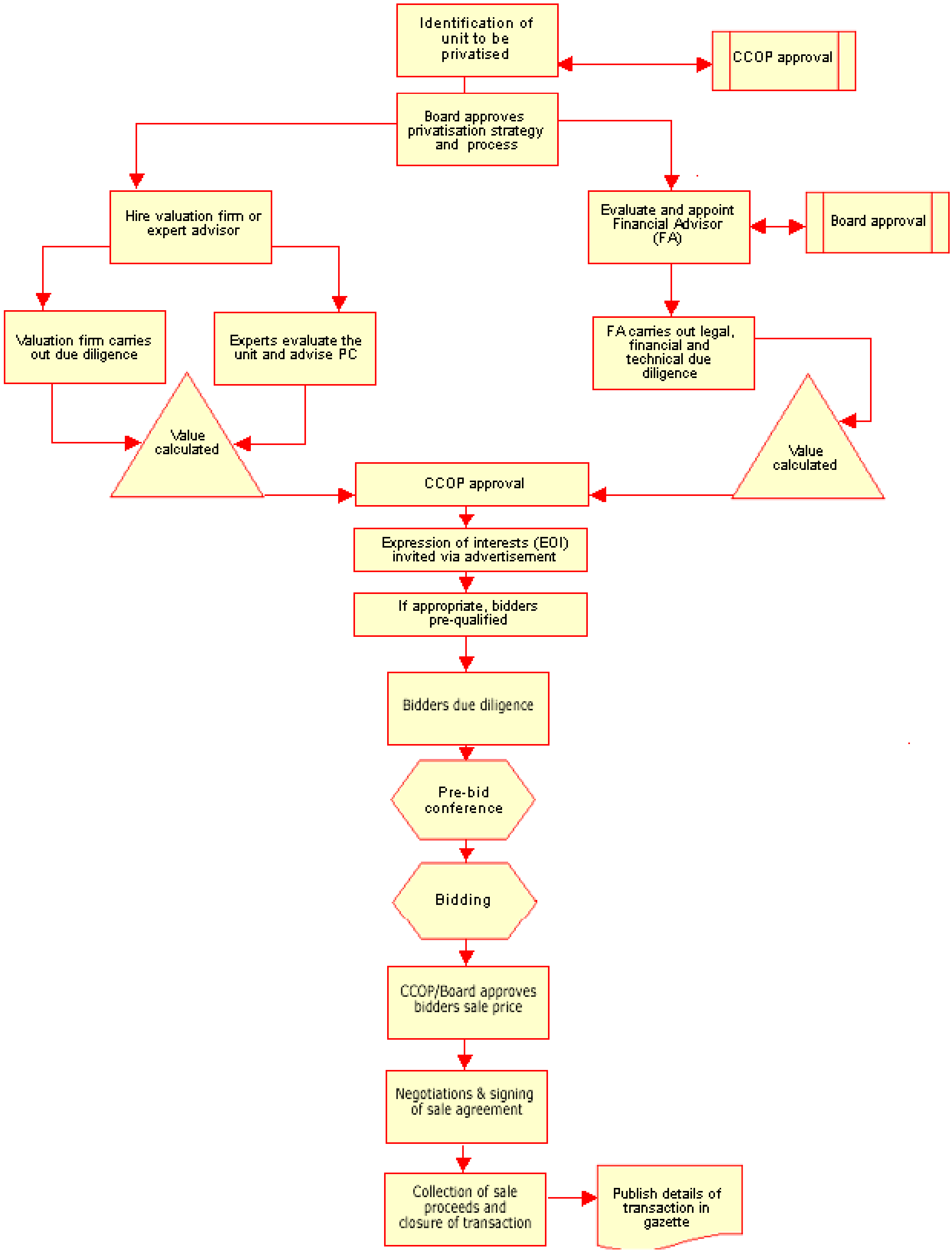
6. Pre-Bid and Bid Process

This step involves seeking the Expressions of Interest (EoI) through advertising in the local or international media (both in some large transactions). According to set laws passed in 2000, the potential bidder/acquirer must meet some conditions. The Commission evaluates the financial strength, source of funds and repute etc. of the bidder and upon satisfaction let the successful investor to submit EoI. Those bidders are also provided some important information at this stage i.e. the Request For Proposals (RFP) package containing the detailed pre-qualification criteria, instructions to bidders, draft sale agreement, and other relevant documents.

7. Post-Bid Matters

Sealed bids are opened in the presence of bidders and highest bidder is identified. The Privatization Commission then makes the recommendations to the CCOP as to whether or not to accept the bid. Depending upon reserve price, the Commission has the authority to accept a bid even if it is lower compared to pre- determined price. Upon approving the price and the bidder, a letter of intent is issued by the Commission containing the terms and conditions of the sale. The Commission then gets approval of the transaction from the CCOP and transfer the ownership from public to private investor. Total duration of the closing of transaction is normally 12 to 18 months depending on simple transaction to selling of relatively complex entities.

Flow chart 2.1: The Privatization Process



Source: Privatization Commission, Government of Pakistan

2.2. Politics and Privatization Progress in Pakistan

As mentioned in the previous section, privatization in Pakistan in major part was initiated to cope with the financial and economic issues surrounding the country rather than an ideology. In the following discussion, I summarize the progress of privatization under different governments in power since the nationalization policy of 1970s.

Nationalization Policy (1971-1976)

After war was lost in 1971, a new government in Pakistan led by the Pakistan Peoples Party nationalized the all major private businesses alongside utilities in response to widespread allegations of accumulation of wealth by few families and business groups. The result of this policy proved to be a disaster as rising wages and oil price shock in 1970s depressed the growth of the economy generally and industrial sector suffered the most. This led to denationalisation demands by the end of 1970s and a white paper in this regard was issued by the then government of army dictator General Zia-ul-Haq.

The military government formed a commission under the Pakistan Industrial Credit and Investment Corporation (PICIC) to explore the areas of deregulation and privatization. The first clear indication of the reversal of nationalization policy came with the introduction of Martial Order in 1978, leading to handing over of three industrial units to their owners including Eittefaq Group of Industries to Mian Mohammed Sharif. Another Martial Order similar to the previous one was promulgated in 1979 for the protection against any further nationalization. In a nutshell, although further nationalization was ruled out after these new laws, a token progress was made in term of actually implementing the policy of denationalisation/deregulations during this period.

Pakistan Peoples Party (1988-1990)

After the death of General Zia-ul-Haq in a mid-air plane accident, new government led by Benazir Bhutto of Pakistan Peoples Party came into power with the promise of no state interference in running of private businesses and pursing a programme of mass industrialization. The government was no longer committed to state enterprise as an engine of growth. Subsequent event proved though that the new Bhutto was although less interested in pursuing the old policy of nationalisation but reluctant to sell already nationalized enterprises. Contrary to government at the centre, provincial government led by the partner/owner of Eittefaq Group sold off nationalized industrial units being run by the provincial government to previous owners without proper bidding process. The price paid by the new owners has not been disclosed since then.

Nawaz Sharif Government (1990-93)

In 1990, the Muslim League government headed by Nawaz Sharif, an industrialist who was committed to free market economy came to power. At the time, surging budget deficit and pressure from donor agencies provided the background of a wide spread privatization of state industrial units. Raising revenues through sale of state-owned enterprise was the easy option available to the then government to cope with the mounting budget deficit. Nawaz Sharif government sold off 66 industrial units and commercial banks to the private sector in 1991-92 (for detail, see Table 2.2).

Table 2.2: First Round of Privatization Process in Pakistan

Sector	Under Nawaz Sharif (1991-93)		Under Banazir Bhutto (1993-96)		Total Privatized Units	To be Privatized later Units	% of Privatized to Total Units
	Units	Bid Value (Million PRs)	Units	Bid Value (Million PRs)			
Automobile	7	1111.9	-	-	7	4	64%
Cement	**8**	**4658.2**	**3**	**2892.6**	**11**	**4**	**73%**
Chemical	6	1039.65	6	570.93	12	1	92%
Fertilizer	1	435.00	-	-	1	7	14%
Engineering	6	119.75	1	28.8	7	6	54%
Ghee	16	588.95	-	-	16	10	61%
Rice	7	204.85	1	32.5	8	0	100%
Roti	12	78.34	-	-	12	1	92%
Misc	1	86.76	5	142.6	6	17	26%
Total	64		16		80	49	62%
Newspaper	-	-	5	92	5	7	42%
Banks	2	1213.6		-	4	16	20%
Power Plants	-	-	1	7546.00	1	10	0.9%
Insurance	-	-	-	-	0	3	0%
Petroleum & Gas	-	-	-	-	0	14	0%
Mining	-	-	-	-	0	3	0%
Communication	-	-	-	-	0	1	0%
Transportation & Airlines	-	-	-	-	0	11	0%
Others	-	-	-	-	0	28	0%
Grand Total	66	9537	38	11305.43	90	141	39%

Source: From Data Provided by Government of Pakistan, Expert Advisory Cell.

Pakistan Peoples Party (1993-1996)

Second phase of privatization started in 1993; when Benazir Bhutto from the Pakistan Peoples Party was sworn in second time prime minister with the top priority of sorting out macroeconomic imbalances. The privatization programme suffered lot of setbacks under Benazir government this time due to party ideological leanings towards socialist form of governance (government as a main provider of employment rather than letting the private sector to generate employment). The progress of privatization was limited to some %age share of the national companies with natural monopolies such as telecommunication, thermal power plant and oil and gas. Some attempts were made to sell larger financial institution such as “United Bank” but failed due to resistance from the media, general public and unions. Overall, by the time Benazir government was dismissed again on the allegations of corruption in 1996, privatization of 20 industrial units, one bank, one electric generation plant and 12% shares of Pakistan Telecommunications Ltd was completed. Credit to Benazir government, no widespread allegations of favouritism was reported in the national or international media or by the pressure groups /civil society.

Nawaz Sharif Government (1997-99)

Contrary to previous stints as a Chief Minister of Punjab (1988-90) or Prime Minister of Pakistan (1990-93), this time progress of privatization was not satisfactory under Nawaz government. One reason could be that selling of smaller industrial units was relatively easy due to loss making nature of these units and comparatively less capital was needed to buy these units. Local banks were able to provide significant amount of capital to buyer of those units without compromising on their risk profile. This time, however focus shifted to financial reforms and establishment of regulatory framework. Accounting standards were refined to make these in line with the international standards. State central bank role in regulating banking industry was strengthened. Some other important reforms include stock exchange reforms, setting/reinforcing competition commission authorities, strengthening the role of security and exchange commission etc. However, the pace of further reforms was halted due to nuclear tests carried out in 1998 and toppling of government by the army dictator General Musharraf.

Musharraf/Aziz Government (2000-2007)

Effort to privatize remaining industrial units and financial institutions were accelerated and intensified again by the investment banker prime minister Mr Shaukat Aziz under the presidency of General Musharraf. The privatization programme was one of the initiatives among many to revive the economy after foreign investment dried up as results of sanctions imposed by the world community due to nuclear explosions by Pakistan in retaliation to India in 1998. Alongside many other policies to revive the economy, Mr Shaukat Aziz promoted the idea of abolishing the culture of industrial patronage to promote competition and productivity. To raise tax collection, this regime imposed sales tax on import items and provided leadership to the struggling public enterprise. As a result of these for reaching reforms, economy witnessed impressive turnaround and the GDP growth peaked to 8% in 2004 from mere 3-4% recorded in the previous government. Inflation dropped to historically low levels, consumer purchasing power improved significantly due to availability of consumer credit and leasing by commercial banks as a result of deregulation policy in the banking sector since 1999.

In term of privatization policy, the government focus shifted from straight privatization to first restructuring the enterprises and then selling. Privatization progress under this regime included 80% privatization of national commercial banks, sale of share of large public sector organisations such as PIA to private investors. By the end of Musharraf government, roughly 85-90% industrial units earmarked for the sale had already been sold to private investors. The commitment of the Aziz government towards privatization and private sector could be judged by the following statement in 2006.

“ Nothing is sacred... I am packaging up my companies. (....).... These state-owned corporations (SOEs) have been well-run for the past few years.... and now I am offering them to investors from all over the world....!”

The privatization programme of this government however, suffered a major setback when superior judiciary of the country (Supreme Court of Pakistan) stopped the government in selling the only Steel Mills on the allegation of misuse of power and non transparent procedures.

Pakistan Peoples Party (2008-2013)

As mentioned above, ideologically, PPP government has been less impressed by the idea of free market and private sector as main employment provider. Considering this, no serious attempt was made since 2008 to privatize remaining public sector loss making organizations such as WAPDA, Steel Mills, PIA etc. Some initiatives were taken to involve private sector in the running of cargo trains without any resounding success. Besides ideologically, PPP was unable to forcefully implement the privatization programme mainly due to resistant from the employee groups and unions who had been traditionally the main supporter of the party.

2.3. Privatization of Cement Industry in Pakistan

Privatization of cement industry started in1984, when the first attempt was made by SCCP to sell part of SCCP shares of Zeal Pak and Gharibwal Cement through the enterprise mutual fund of the Investment Corporation of Pakistan (ICP). Shares of Rs.30 millions were sold by SCCP to ICP at the market price, which sold them without any difficulty as part of mutual fund to the public. In 1992, the cement companies like Dandot Cement, D.G.Khan Cement, Kohat Cement, Mapple Leaf Cement, Gharibwal Cement, White Cement and Zealpak Cement were privatized. Out of 8 units privatized in 1991-92, 6 units were sold to already establish industrial groups, which have already experience of managing industrial units in Pakistan[4] and remaining 2 units were sold to "Employees Group". The details of privatized units are given in Table 2.3.

At the time of privatization of these units, total numbers of employees working in different fields were 5520. Government on the eve of privatization implemented a golden handshake scheme for workers. The response by worker was encouraging and some 20-30% workers opted for the scheme. Government restricted for payment of 40% of bid value at the time of transfer of ownership. The amount of this money received was 2297.19 millions at that time, and 2860 millions was to be received later. The privatization process for Thatta Cement and Mustehkam Cement was also completed at that time and only payment was delayed, and finalized later due to cases

[4] D.G. Khan Cement was sold to Mansha and Saigal group. Dandot Cement was initially sold to Employees group, but they latter sold to Chakwal Group of Industries. Mapple Leaf was sold to Saigol Group of Industries. Similarly Kohat Cement was also sold to Palace Enterprises, another industrial group.

pending in courts. The privatization of Associated Cement Rohri and Wah and General Refractors were completed in 1996 and Javadan Cement in 2003.

Table 2.3: Details of Privatized Cement Industrial Units

Name of Unit	Name of Successful Bidder	Date of Bidding	Date of Transfer	Total Bid Value (Rs. Million)	Amount Received (Rs. Million)	Number of Employees
White Cement Ltd.	Jehangir Elahi & Associates, Lahore	17-10-1991	08-01-1992	137.47	54.99	133
Pak. Cement Ltd.	Jehangir Elahi & Associates, Lahore	17-10-1991	08-01-1992	188.95	75.58	240
Mapple Leaf Cement Ltd.	Nishat Mills LTD. & Associates, Lahore	17-10-1991	08-01-1992	291.28	116.51	603
D.G.Khan Cement Ltd.	Tariq S. Saigol & Associate, Lahore	17-10-1991	02-5-1992	1799.67	1109.77	503
Dandot Cement Ltd.	Employees Group	17-10-1991	28-05-1992	636.69	254.68	677
Gharibwal Cement Ltd.	Haji Saifullah & Group, Islamabad	20-4-92	26-09-1992	836.33	334.53	930
Zeal Pak. Cement Ltd.	Sardar M. Ashraf D. Baluch, Karachi	19-4-92	10-10-1992	239.93	95.97	1402
Kohat Cement Ltd.	Palace Enterprises Ltd.	18-4-92	31-10-1992	527.9	211.16	766
National Cement Ltd.	Employees Group	23-11-92	na	110.00	44.00	266
Total	7 Groups	13 Months	10 Months	4768.00	2297.19	5520
Thatta Cement Ltd.	-	22-11-1992	-	537.03	-	662
Mustahkam Cement Ltd.	-	29-07-1992	-	1843.59	-	1297

Details of Cement Industrial Units Privatized in 1996

Name of Unit	Products Produced	Zone	Province	Annual Production Capacity	Total Paid-up Capital	Number of Employees
Associated Cement, Wah	Ordinary Portland Cement	North	Punjab	450,000.00	1357	1012
General Refractories Ltd.	Fire Bricks	South	Sindh	4,400.00	21.551	139
Details of Cement Industrial Units Privatized later						
Javadan Cement Ltd.	Ordinary Portland Cement	South	Sindh	6,000,000.00	88.12	1026
Associated Cement Company, Rohri	Ordinary Portland Cement	South	Sindh	270,000.00	1012	790

Source: Privatization Commission (PC), Government of Pakistan and Expert Advisory Cell, GOP.

2.4. Cement Industry of Pakistan

Cement manufacturing is a well-established industry in Pakistan, accounting for about 5.5% of total industrial production, representing 1.4% of GDP and contributing 30 billion Rupees annually to national exchequer. The industry has witnessed a significant transformation since the deregulation and privatization started by the end of 1980s and early 1990s. The industry has become global exporter of cement and has been ranked 5th largest exporter of cement. In the following discussion, main feature alongside issues of the industry are discussed.

2.4.1. Historical Development

Cement manufacturing began in 1921 when Pakistan's first plant was installed with a capacity of 44,500 ton per year (tpy) and the industry grew steadily until independence. In 1947, at the time of independence, two companies with a total of four plants (all in the private sector) were in operation with a total capacity of 480,000 tpy. During the 1950's and 1960's, 6 more plants were established, 4 in the private sector and 2 (Zealpak and Maple Leaf) in the public sector by Pakistan Industrial Development Corporation (PIDC). The industry maintained a growth rate of 9.7% per annum in installed capacity. By the end of 1971 production capacity of cement had increased to 3.45 million tpy, with 58% in the public sector and 42% in the private sector, respectively.

In January 1972, cement industry was nationalized and all the plants were placed under the Board of Industrial Management (BOIM). The nationalization was formalized in

1973, when the State Cement Corporation of Pakistan Ltd. (SCCP) was constituted as a holding company under the control of the Ministry of Production (MOP). All the major private share holding in the cement companies were acquired by the Government of Pakistan (GOP).

At the time of SCCP formation, the company consisted of 9 portland cement and one white cement plants, with an overall production capacity of 3.42 million tons per year (tpy). These plants had been exporting substantial amount of cement to Bangladesh, which ceased after mid-1971. Other markets were found after 1973 and exports reached a peak of 0.496 million tons in 1974-75. By 1975-76, substantial remittances of foreign exchange by Pakistani working in the Middle East resulted in an increase in the demand for cement. In 1976-77, the country had become a net importer and cement was being sold in black markets.

To partially meet the demand, the SCCP plants were run at near capacity. The capacity utilization of the plants increased from 82.0% in 1972-73 to 96.4% in 1979-80. The total production capacity of SCCP increased to 4.125 million tons per year in 1981-82. However, capacity utilization decreased to 88.7% in 1981-82 as against 96.8% in 1980-81. In response to continuing shortages, the GOP lifted the ban on private investment in cement in 1978, and announced an incentive package for private investors consisting of a guaranteed rate of return of 15-20% and reduction in import duties for equipment and corporation tax exemptions depending on plant location. Subsequently, SCCP increased capacity by 2.1 million tpy, through six projects comprising two expansions and four green-field plants, while, some two dozen private investors received sanctioning approval. By the beginning of 1987, four private plants, comprising about one quarter of sub-sector capacity, had started operation.

At the beginning of 1986-87, the Pakistan cement industry consisted of 17 operating plants, with a total nominal installed capacity of 7.7 millions tpy. Thirteen of the plants, comprising about 6.0 million tpy (78% of total capacity) belong to SCCP[5] and 4 private plants[6] with installed capacity of 1.63 million tons. At the end of 1996, total number of cement companies increased to 23, with 6 firms entering the market during 1988-96, all in private sector. Since then, some new firms entered the market and some older firm had been acquired by the competitor firms. Government of Pakistan has successfully implemented the privatization policy and by 2003, all the companies belonging to public sector were privatized.

Besides, in order to enhance their production capacity, majority of existing units have expended their production capacity. After commissioning of new units, and mergers, number of cement manufacturing plants in the country in 2011 was 21, and the production capacity will increase to 45 million ton per year (tpy). Of those new units, some are located in the Punjab and rest in the Khyber Pakhtunkhwa (KPK) province. Two of the new units in Punjab have the production capacity of 0.990 million tons each, while, Pioneer Cement and Lilla Cement has the capacity to produce annually 0.660 and 1.5 million tons respectively. The complete detail of the historical development of cement industry of Pakistan is shown in Table 2.4.

[5] Nine plants produced only ordinary port land cement (OPC), two produced both OPC and slag cement, one produced OPC and sulphur resistant and one produced OPC and white cement.

[6] Private companies in operation were Pakland, Cherat, Dadabhoy, and Attock at that time.

Table 2.4: Pre Reforms Historical Development of Cement Industry of Pakistan

Year	Units Inherited Established	Location	Installed Capacity (000) tpy	Additional Capacity (000) tpy	Year of Expansion	Current Capacity (000) tpy	Established in Private/ Public Sector	Current Position Private/ Public Sector	Remarks	Process	Zone	Province
1947	Associated Cement C)	1.Wah	450	541	1985&94	991	Private	Public		Wet	North	Punjab
		2.Rohri	270	-	-	270	Private	Public		Wet	South	Sindh
	Dalmia (National) Cement	1.Karachi	160	-	-		Private	-	Closed	Dry	South	Sindh
		2.Dandot, Jhelum	50	-	-	50	Private	Private	Privatized	Dry	North	Punjab
1956	Zeal Pak Cement	Hyderabad	120	860	1961&70	1080	Public	Private	Closed	Wet	South	Sindh
	Maple Leaf Cement	Mianwali Daudkhel	100	200	1963&65	501	Public	Private	Privatized	Wet	North	Punjab
1964	Javedan Cement	Karachi	300	300	1980	300	Private	Public		Semi Dry	South	Sindh
	Gharibwal Cement	Gharibwal, Jhelum	360	180	1968	540	Private	Private	Privatized	Wet	North	Punjab
1966	Mustehkam Cement	Hattar	360	300	1980	630	Private	Public		Semi Dry	North	Punjab
1967	White Cement Industries, Maple Leaf	Iskanderabad Daudkhel	15	15	1982	30	Private	Private	Privatized	Wet	North	Punjab
1983	Thatta Cement	Thatta	330	-	-	330	Public	Public		Dry	South	Sindh
	Kohat Cement	Kohat	330	-	-	330	Public	Private	Privatized	Dry	North	Punjab
	Dandot Cement	Dandot, Jhelum	300	-	-	330	Public	Private	Privatized	Dry	North	Punjab
1985	D.G. Khan Cement	D.G. Khan	680	-	-		Public	Private	Privatized	Dry	North	Punjab
	Pakland Cement	Deh Dhando	330	-	-	390	Private	Private		Dry	South	Sindh
	Cherat Cement	Nowshera	330	300	1995	660	Private	Private		Dry	North	KPK
1986	Dadabhoy Cement	Kola Kohar	300	150	1993	409.5	Private	Private		Dry	South	Sindh
	Attock Cement	Hub Chowki	600	-	-	600	Private	Private		Dry	South	Baluchistan
	Sarela Cement	Darwaza (Quetta)	70	-	-		Private	Private	Closed	Dry	South	Balluchistan
1988	Essa Cement	Nooriabad	150	300	1997	450	Private	Private		Dry	South	Sindh
	Pak Cement	Iskandarabad	171	-	-	171	Private	Private		Dry	North	Punjab
	Anwarzeb Cement	Bholari	50	-	-		Private	Private		Dry	South	Sindh
	Fecto Cement	Sanghani	300	300	1989	600	Private	Private		Dry	North	Punjab

Source: Compiled from:
Annual Report, Expert Advisory Cell, GOP (Various issues).
World Bank (1986).
Business Recorder (various issues).
Companies' Annual Report (various issues).

2.4.2. Pricing Policy and Distribution

Prior to 1985, SCCP established the price of cement for each plant, including wholesale and retail price. This was done through a system of average cost pricing coupled with cross-subsidization schemes at the plant and regional market levels. A "retention" price (SCCP wholesale price less taxes and duties) was established for SCCP cement as a whole, on the basis of average production costs, including an overall rate of return on fixed assets of approximately 15%. At the plant level, price paid to each plant was the retention price plus development subsidy in the case of high-cost producers or minus in the case of low-cost producers. It assured each factory a more or less 15% rate of return on equity. Retail prices in each locality were arrived at by adding to the wholesale price an allowance for transport costs (to avoid disparities in cement prices in different areas). SCCP established the dealer margin for major consumption areas whereas elsewhere, government administrators such as District Deputy Commissioners (DC) set the margins.

In June 1985, government of Pakistan abandoned the long-standing cement price controls and freight equalization. Following price decontrol, SCCP introduced a number of changes in its pricing procedures. First, the freight equalization scheme was abolished and dealers were now responsible for making their own transport arrangements. There had not yet been any basic changes in the system of cross-subsidization of production at the plant level, but SCCP plant managers were allowed to vary the ex-plant price. Only two plants took advantage of the more flexible pricing policy, one southern plant selling below SCCP's standard ex-factory price and a northern plant selling above it. Plant managers however, were expected to become increasingly responsive as competitive pressure from the private sector increased.

After the privatization of public sector plants, SCCP lost its control over the cement sector and All Pakistan Cement Manufacturer Association (APCMA) now represents more than 80% of cement manufacturers and sets the agreed upon price by all its members.

2.4.3. Market Structure and Technology

The market for cement in Pakistan has been unsophisticated and narrow in the past, and little effort was made to promote demand for cement, other than Ordinary Portland Cement (OPC)[7]. Before 1981 when the private sector was first allowed to import and market cement, the government through SCCP, controlled all sales and distribution of cement in Pakistan. SCCP determined regional quotas, arranged for transportation of cement and established allocation for public sector agencies. Cement market in Pakistan has undergone both quantitative as well as qualitative change after liberalization and privatization process of 1992. The market is now, no longer a "seller market" and prices have responded to market forces following a series of events such as commissioning of several private cement plants, government decision to abandon cost-plus pricing, decontrolling market prices with elimination of freight subsidy and the competitive market environment after deregulation and privatization.

[7] In 1985-86, OPC comprised approximately 95% of subsector output, with slag cement and sulpher resistant cement comprising about 2% each of the market and white cement the remainder.

The cement market in Pakistan is divided into two geographical zone i.e. north and south zones. The former covers KPK, Azad Jammu and Kashmir and part of Punjab (North of Rahim Yar Khan district), whereas the latter covers Sindh, Balochistan and rest of Punjab. The north zone is now served by a total of nineteen companies, while, the south zone is served by a total of five companies. At present, out of the total production capacity of clinker about 83% is in the north and the balance 17% in the south (see Table 2.5). Higher ratio of capacity located in north region is mainly due to ease of raw material availability and proximity to two big export markets (India and Afghanistan).

Table 2.5: Installed Production Capacity (As on April 2012)

Sr. No.	Name Of Unit	Operational Capacity	
North Zone		Clinker	Cement
1	Askari Cement Limited - Wah	1,050,000	1,102,500
2	Askari Cement - Nizampur	1,500,000	1,575,000
3	Bestway Cement Limited - Hattar	1,170,000	1,228,500
4	Bestway Cement Limited - Chakwal	3,428,571	3,600,000
5	Bestway-Mustehkum Cement Limited - Hattar	1,035,000	1,086,750
6	Cherat Cement Company Limited-Nowshera	1,050,000	1,102,500
7	Dandot Cement Limited - Jehlum	480,000	504,000
8	Dewan Hattar Cement Limited - Hattar	1,080,000	1,134,000
9	D.G.Khan Cement Limited - D.G.Khan	2,010,000	2,110,500
10	D.G.Khan Cement Limited - Chakwal	2,010,000	2,110,500
11	Fauji Cement Company Limited - Fateh Jang	3,270,000	3,433,500
12	Fecto Cement Limited - Sangjani	780,000	819,000
13	Flying Cement Limited - Lilla	1,140,000	1,197,000
14	GharibWal Cement Limited - Jehlum	2,010,000	2,110,500
15	Kohat Cement Company Limited - Kohat	2,550,000	2,677,500
16	Lucky Cement Limited - Pezu	3,725,714	3,912,000
17	Maple Leaf Cement Factory Limited - Daudkhel	3,210,000	3,370,500
18	Lafarge Pakistan Cement Company Limited - Chakwal	1,950,000	2,047,500
19	Pioneer Cement Limited - Khushab	1,933,571	2,030,250
	Sub Total (North Zone)	35,382,857	37,152,000
South Zone			
1	Al-Abbas Cement Limited - Nooriabad, Dadu	540,000	567,000
2	Attock Cement Pakistan Limited - Hub Chowki, Lasbela	1,710,000	1,795,500
3	Dewan Cement Limited - Dhabeji	750,000	787,500
4	Lucky Cement Limited, - Indus Highway, Karachi	3,428,571	3,600,000
5	Thatta Cement Limited - Thatta	300,000	315,000
	Sub Total (South Zone)	6,728,571	7,065,000
	Grand Total (North+South)	42,111,428	44,217,000

Technology of Production

Cement manufactured in Pakistan is generally called Portland cement because of its gray colour like Portland stone in Britain. Another variety is Sulphate Resistant cement, which is helpful in controlling chemical attacks. It also gives more resistance to building where soil is affected by water logging and salinity. Historically, there were three methods being used in cement production called wet and dry and semi-dry process[8].

A. Limestone crushing: The size of the quarried limestone is reduced using the crushers. The crushed limestone is stacked in pre-blending stockpile, laying each batch of crushed limestone down in layers. To achieve a considerable degree of homogenization, the limestone is reclaimed systematically in a vertical manner.

B. Clinkerization-Wet Process: The crushed limestone is fed into a raw mill (i.e. horizontal-rotating mills called ball mills). Other additives such as bauxite, manganese ore, iron ore and water are also fed with limestone in the right proportion. The resultant product is raw-meal, which will be in the form of slurry. The raw meal is then fed into a horizontal rotating kiln. Pulverized coal and a fraction of furnace oil, if required, are used as fuel to burn the slurry into clinker. Since the water (about 350%) in the raw-meal has to be evaporated, the wet kilns consume about 350 kg to 400 kg of coal for production of 1 ton of clinker.

[8] Following discussion is based on the report on cement industry by Khadim Ali Shah Bukhari & Company Ltd. (1995) titled "Pakistan Cement Industry".

C. Clinkerization-Dry process: The crushed limestone along with appropriate proportion of additives, such as bauxite, manganese ore, and iron ore are fed into the vertical roller mill. The resultant output is dry, powdered form raw-meal. The raw-meal is then fed into horizontal rotary kilns. The pulverized coal and a fraction of furnace oil, if required, are used as fuel to burn the raw-meal into clinker. Since no water evaporation is required in the dry kiln, the coal consumption in this process is only around 200 kg for the production of 1 ton of clinker.

D. Cement Grinding: The clinker produced in wet/dry kiln can be stored in the open yard for a maximum period of 3 months, without deterioration in the quality. The clinker is fed into a horizontal rotating cement mill with about 8- 10% gypsum. The resultant finely ground product is called Ordinary Portland Cement, (OPC). In order to obtain pozzolanic materials such as fly ash and broken tiles (to the extent of 10-15%) are added to clinker and gypsum in the cement mill. The cement is stored in cement silos, and is subsequently packed and dispatched.

2.4.4. Entry and Exit Conditions

The condition of entry to an industry is one of the important structural parameter, which determines the performance of firms in that industry. It measures the magnitude of the barriers to entry for new entrant. In most of the industries, stability of entry conditions determines the absolute cost advantages enjoyed by established firms because of technology and resource control which including access to distribution channels. The conditions of entry to industry may change over the time, and in some cases, they change quite remarkably within relatively short period of time because of rapid lowering of entry barriers. This can led to rapid changes in profitability and efficiency of the existing firms as well as new entrants.

Historically, entry conditions in the Pakistani cement industry had been strict because of strategic importance. But, since the deregulation in the industry in early 1990s, entry conditions eased up considerably. Despite of the fact that entry conditions have eased up quite significantly since 1990, implicit entry restrictions are still in place due to huge investment and funds needed to set up the cement plant. According to APCMA estimates, the average cost for setting up a grass root cement plant was around Rs.1500 per ton of clinker as of 1988 prices. On this basis, a million-ton plant required about Rs.1500 millions. Further, with the increase in marketing cost and distribution network due to competition, it became necessary for the manufacturers to extend better credit lines to the distributors. This has further raised capital requirements in the industry. The necessity for installation of captive control equipment to check dust emission and installation of captive power generators to overcome problem of power shortage, have also raised the capital requirements. Therefore, the large financial resources are required for installing cement manufacturing facilities, which can be considered as a barrier to entry.

However, deregulation in the banking industry and growth in credit has eased this implicit entry barrier to some extent in the last few years. This led to a series of new entrants including some plants being set up in the areas where cheap raw material and labour was available. It has provided the comparative advantage to the new entrant, which resulted in price war among the new entrants and the firms already in the business. The ultimate effect of the easy entry and exit has been the improvement in use of inputs.

2.4.5. Demand and Supply Constraints

Demand and supply interaction determines the equilibrium price provided that the big monopoly houses of public ownership or cartel-led monopolistic market in private sector do not dominate the market structure. Any distortion, which disturbs this interaction could leads to changes in the profitability patterns and thus ultimately forcing the supplier to bring broad-based changes in the production. If demand decreases continuously, it can work in two ways: first it could depress the profitability of the industry in general; secondly, it can force the producer to go for efficient use of human and financial resources.

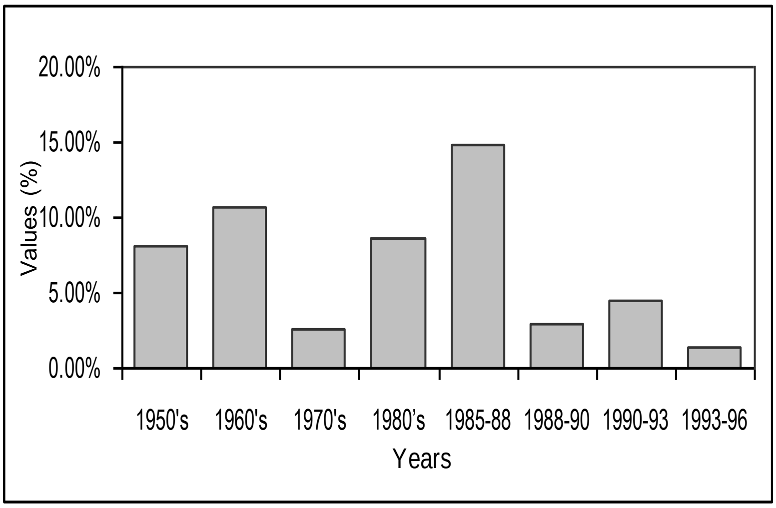
Domestic demand for cement has grown at different average growth rates during the last 50 years. In the 1950's growth rate was 8.16% per annum; during1960 it witnessed the highest average growth rate at 10.68% per annum[9] ; 1970's was a depressed decade[10] and growth rate remained 2.52% per annum; in 1980's growth rate was 8.5% per annum (see Figure 2.1). In 1990's growth rate was recorded at 3%, where 1993-95 experiencing even negative growth rate. On the supply-side, since 1980, sub-sector capacity has increased at the rate of roughly 10% per annum during 1980-87, 7.5%

[9] It was the period of constructing big dam's extension of irrigation facilities and, road network development.

[10] GOP's nationalization and labour policies, war with India and separation of East Pakistan, oil crises depressed the industrial activities, economy and demand for cement during 1970-78.

during 1992-96 and 6.07% during 1986[11]. These uneven demand- supply growth rates during 1990s have forced the producers to compete on efficiency basis or use cost efficient technology and get improved productivity. Secondly, in 1970s and 1980s, there has been a shortage of cement in the north zone due to high pace of industrialization. South zone with high capacity and lower demand was capable to export the excessive supply to north. The high transportation costs were subsidized by the SCCP. But after privatization, the share of northern region in total cement sales grew from 59.5% to 64% against a capacity of about 56.7% in 1989-90 and 58.5% in 1995-96 due to expansion of older plants and new entrants. And this increased to 71.3% by 1999-2000. In this new scenario, a competition was developed between the north and south zone in efficient utilization of resources.

Figure 2.1: Cement Industry Production: Average Growth Rates



[11] The production of cement increased from 7.76 million tones in 1990-91 to 8.42 million tones in 1994-95, showing a growth of 1.6% per annum. However, after the expansion of State Cement Corporation of Pakistan, production capacity of existing and new plants in public and private sector is expected to go up to 12.7 million tones to be more than the demand of 9.7 million tones for that period. Pakistan will have a surplus of more than 1.6 million tones of cement in 1996-97 which will rise to a staggering 6.3 million tones in 1997-98.

2.4.6. Foreign Investment

Cement industry was among few industries that Pakistan inherited at the time of independence. Since then, the industry has always been set-up and run by the local investors. Deregulation and privatization was initiated to change this by easing up entry conditions and allowing domestic banks to lend money to domestic and foreign investors. Reducing the role of state authorities in setting prices and margins was also perceived as an incentive for new firms' entry (local as well foreign). Portfolio invest by foreign investors was already in place, but direct investment was missing. Since the deregulations measures, two foreign companies have made significant investment in the sector. Interestingly, $45 million investment from one of the Saudi financier in Attock cement was one the largest foreign investment from Middle East in Pakistan. Another company receiving foreign investment is Chakwal Cement. The company has attracted investment from one of the largest French cement producer Lafarge. These investments are on top of portfolio investments by foreign investors. An examination of shareholding patterns of cement sector companies revealed that two firms have more than 30% foreign shareholding and one of the largest cement producers D.G. Khan Cement with 15% foreign shareholding. It is anticipated that once law and order situation gets better in Pakistan, more direct and indirect investment is likely to be made in the industry.

2.4.7. Diversification and Vertical Integration

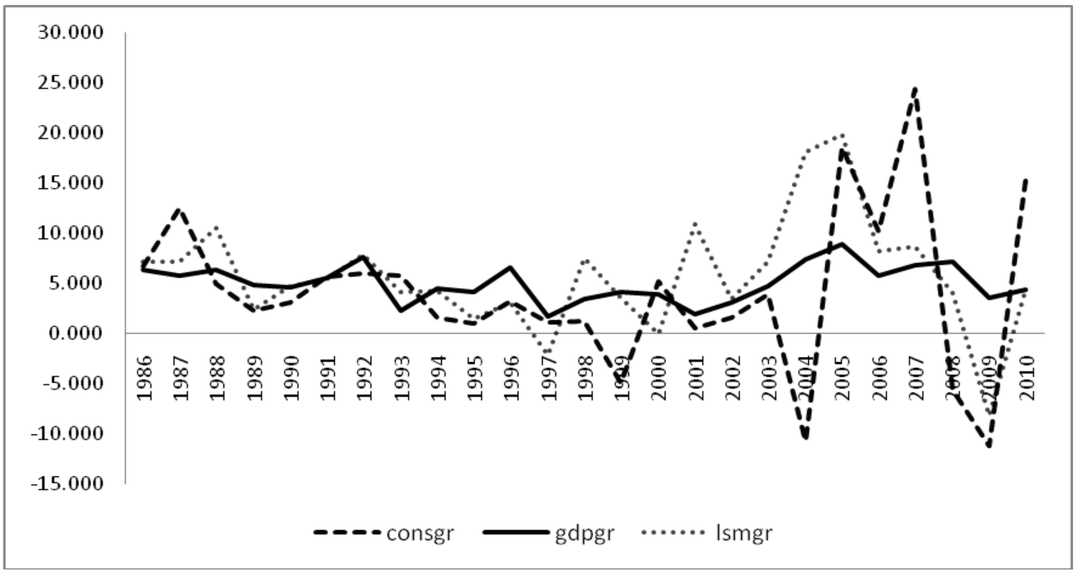
Cement industries across the worlds have been subject to vertical integration and diversification and as the competition intensified, the companies would like to integrate vertically by moving into the ready-mix concrete business, shipping business etc. or to become part of business conglomerate. Many large global cement producers like Lafrage have moved to vertically integrating core activities of cement, ready-mixed concrete and sand and gravel. In the Pakistani cement industry, vertical integration activity has not been in practice except Chakwal cement which is part of Lafrage group, it is hoped that as the competition gets stiff, firms are likely to diversify in other businesses and buy or merge with other companies to reduce their advertising, marketing, shipping and distributions costs. Lot of Pakistani cement firms are already part of big diversified business groups, but in significant number of cases, the nature of the business is completely different (like DG Khan Cement is part of Nishat Group with businesses in textile, cement, financial services, insurance, power generation, paper, hospitality industry, agriculture, dairy industry and aviation). Pakistan cement producers being 5th largest exporter of cement are expected to make significant progress particularly in the shipping industry in this regard in near future.

2.4.8. Economic Growth and Investment

The performance of the cement industry is highly dependent on the construction activities within the country. A boom in the construction industry ensures the stable demand, which translates into higher capacity utilization and economies of large-scale operation. Economic policies of high growth of investment in construction sector by the government could cause the sequential growth in demand for cement that would yield the increase in sales volumes and profitability of the industry. Figure 2.1 & Figure 2.2 reveals some interesting trends in GDP growth (gdpgr), construction growth (consgr), large scale manufacturing activity growth (lsmgr) and growth rates in government construction sector (GFCF) in pre-, immediate post and matured period of post privatization period.

Immediately after privatization, the economic conditions of the country were fragile, in term of growth rate of Gross Domestic Product (GDP) as well as large-scale manufacturing sector (see Figure 2.2). The growth rate was 3-4% p.a. during 1990-96 against the historical growth rate of 5-6% p.a. in the last 30 years. Large-scale manufacturing sector also showed a declining trend since 1993. The overall trend in construction sector excluding few exceptional years due to mega projects like motorway, reconstruction of flood-effected houses, roads, railways and commercial buildings was generally disappointing. Total public sector investment in term of gross fixed capital formation (GFCF) was either curtailed in to some specific sectors or remained stagnant since 1993 (see Figure 2.3). All these factors sent negative signals for construction activities in 1990s and could have an impact on profitability and efficiency of the overall industry during these years.

Figure 2.2: Real GDP Growth Rates, Large-Scale Manufacturing and Construction Sector



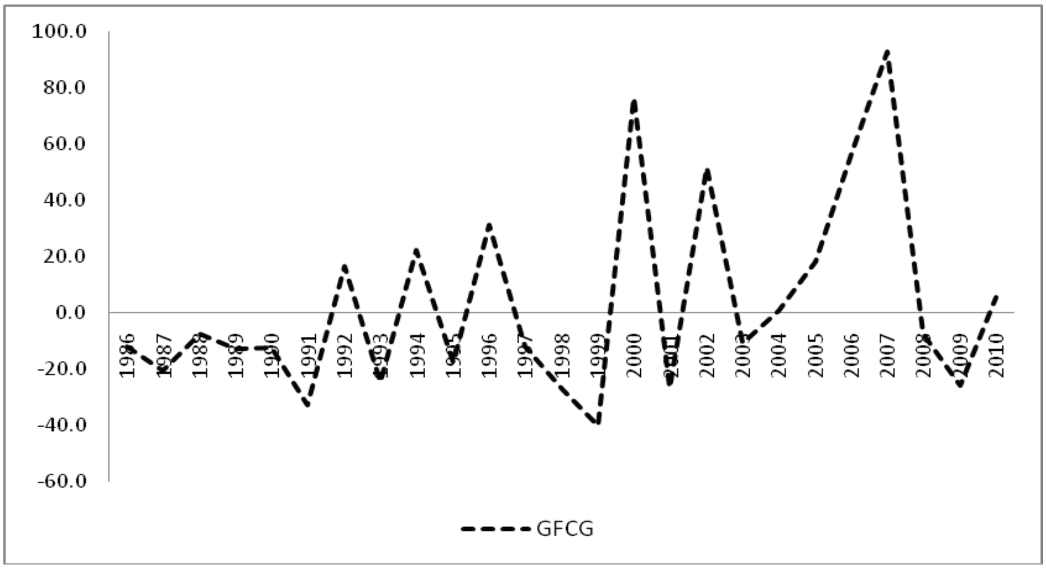
However, from 1999 onward, government investment in construction sector stimulated the growth of construction industry significantly. Overall, by looking at two graphs, some interesting observations could be made i.e.

- During 1986-98, investment remained more or less same (with negative growth for most of the years). The construction sector growth rate during this period declined.

- During 1990-92, construction sector remained more or less stagnant due to the fact that during this period, most of the funds were allocated to the maintenance of the flood-effected buildings and roads.

- Period of 2002 onwards, however, shows the deviation from the past. During this period both investment and construction sector have grown albeit with some downward pressures.

Figure 2.2: Annual Growth Rates in Government Construction Sector GFCF



CHAPTER 3

Performance Indicators and Choice of Criterion

This chapter is comprised of discussion on the change/nature of ownership structures and performance. The chapter starts with the basic question of privatization: what happened? and why did it happen? This is supplemented by the comprehensive literature on the nature of ownership and firms' performance. A detailed review of the 1980s and 1990s main studies in this area is presented. In the next section, conclusions from the recent literature on the ownership and performance are presented by distinguishing the studies according to the firms' nature of business. Subsequently, discussion moves to various performance indicators, competing methodologies, and their suitability for the comparison of different ownership structures.

3.1. Introduction

Does privatization enhance efficiency? The importance of this question follows from fundamental changes in the revealed preferences of the Pakistani government in the 1980s. Internationally, the mass transition from centrally planned economic systems to decentralized decision making process has not been unnoticed and indeed, there is a vast body of literature on the subject (privatization) itself, and the performance evaluation of these divested enterprises. Most of the literature, however, in the early stage of privatization was based on traditional and political arguments, and largely descriptive (Galal *et al.* (1994)).

A fundamental question in this regard is whether deregulation and privatization (reform policy, henceforth) improves operating and financial performance of the privatized firms. For example, Galal *et al.* (1994) raised a basic question: Is a country better or worse off when its government divests its public enterprises. In other words, what happen as a result of divestiture, why did it happen? Who wins and who loses, and how much? Comprehensive answers to all these questions raise few subsidiary questions such as, what will happen. What is it worth? For answering all the above questions, one needs a detailed cost-benefit analysis of the policy and distribution of gains to different segments of society/economy, such as consumers, buyers, and employees, etc. My study, however, is confined to first two questions[12].

[12] My initial plan was to do a comprehensive cost-benefit analysis of the policy but constraints like nature of study; data limitations and time involved forced us to be confined to the answering of only these two questions. It may be extended at later stage of the study.

Privatization: What Happened?

This is the problem of factual analysis. It needs comparison of ex-ante and ex-post privatization performance of the firms, on the basis of some well defined indicators either economic, financial or both.

Privatization: Why did it happen?

It needs explanation, whether divestiture is the main source of variation in the performance or some other exogenous changes i.e. industry or the economy are responsible. One could derive insight based on comparison of three groups of firms including private, privatized and public. This could provide the opportunity to evaluate the performance of three groups of firms working in relatively similar market and economic conditions.

3.2. Early Studies on Ownership, Deregulation and Performance

Privatization wave of 1980s fuelled the ongoing debate on the matter. The early literature on the question of ownership and performance is full of contradictory results (see Table 3.1). Broadly speaking, two sets of conclusions have been emerged from the case studies. First finds private ownership clearly superior, while, second favours the public sector operation or at least does not consider public ownership as a hurdle to efficient operation. The most notable early studies that support these conclusions are summarized below:

According to Bennett and Johnson (1979), "Without exception, the empirical findings indicate that the same level of output could be produced at substantially lower costs if, output is produced by the private rather than the public sector".

Caves and Christenson (1980) finds "Contrary to what is predicted in the property rights literature, I find no evidence of inferior efficiency performance by the government owned railroad, public ownership is not inherently less efficient than private ownership….the oft-noted inefficiency of government enterprises stems from their isolation from effective competition rather than their public ownership per se."

Sheikh (1985) conducted the study of the consequences of public ownership on the operational performance of the ghee industry of Pakistan. The study utilized the data on eighteen firms over ten-year period. The author used the national income techniques for calculating public profits and profitability. He finds that the average level of performance after adjusting for changes in prices and capital stock is higher for the period under public ownership as compare to private ownership regime. He further found that improvement in performance was accompanied by improved productivity of capital.

Aharoni (1986) finds "The empirical evidence …lends only limited support to the hypothesis that SOEs [state-owned-enterprises] are less efficient than private firms. The financial results of SOE's certainly show a dismal picture of losses. However, these losses may be a result of social and political demands on the enterprises. In terms of efficiency, these enterprises' performance is much less bleak. As efficient users of resources, they may have done as well as private firms producing the same product in the same country."

Atkinson and Halvorsen (1986) estimated cost efficiency for a sample of 30 public and 123 private fossil-fuelled electricity generating monopolists and concluded that public and private enterprises did not differ in costs significantly, but both had higher costs.

The study by Forman-Peck and Manning (1988) compares the performance of British Telecom with five telecommunication companies elsewhere in Europe. The study summarizes that "British Telecom is apparently less efficient…than the telecommunication enterprises in both Norway [where the company is state-owned] and Denmark [where ownership is mixed] but more efficient than those in Spain and Italy [where ownership is also mixed]."

Boardman and Vining (1989) study finds "There is robust evidence that state enterprises and mixed enterprises are less profitable and less efficient than private corporations". Similarly, Boycko *et al.* (1993) finds that there is virtually universal consensus that privatization improves efficiency.

Boardman and Vining (1989) finds "The evidence suggests an "edge" for the private sector, but the results vary considerably across sectors. In sectors where there is some evidence of superior public efficiency (electricity and water), there is limited competition or the private firms are highly regulated. Evidence of the greater efficiency of [private companies] appears to be in the delivery of services where government's subcontracts to the private sector and their monitoring costs are relatively low."

Bishop and Kay (1989) evaluated the consequences of British privatization program. The study finds that most privatized industries are grown since privatization and grown more than those industries that have remained in public ownership. However, the study finds that the privatized firms, which are doing well and grown rapidly, were doing better even before privatization. Similarly, the output and profits are grown, margins are increased, and employment has declined. The study finds that privatized industries tend to grow faster and are more profitable, but it seems that the causality runs from growth and profitability to privatization, rather than the other way round.

Naqvi and Kemal (1991) examined the privatization of public industrial enterprises in Pakistan. The study shows that, some public enterprises show losses, most of these units made sufficiently large profits, and that their high rates of profit cannot be attributed to the high rates of protection. The study finds that the average rate of protection for industries in the public sector is lower than that of the industries in the private sector. Further, the study ruled-out the possibility of public sector monopolistic practices, significant fiscal sports as well as greater 'peoples' equity participation by privatization.

Megginson *et al.* (1994) analyzed the pre- and post-privatization financial and operational performance of 61 companies, from 18 countries and 32 industries, that experienced full or partial divestiture through the public share offering during the period 1961 to 1990 by using financial ratios. Specifically, the study used profitability, efficiency, leverage, employment and capital investment spending ratios. The study documented strong performance improvements, without lowering employment. After privatization, firms increased real sales and capital investment spending; improved their operating efficiency and expanded their work force and become more profitable. Further, these firms lowered their debt levels and increased dividend pay-outs. The study also found significant changes in the size and composition of corporate board of directors after privatization.

A thorough empirical study is of World Bank by Galal *et al.* (1994). The study analyzed the privatization performance of the twelve companies of Britain, Chile and Malaysia. The study raised the question that either the transformation of private ownership increased efficiency? and if yes, then, with how much costs and benefits allocated. The study finds welfare gains in 11 out of 12 companies; no significant case of workers lay-offs and in three cases, performance under private sector was significantly better.

Bousoffiane et.al (1997) by using Data Envelope Analysis (DEA) analyzed the effects of privatization on nine organizations privatized in the UK in 1980s. The study analyzed the technical efficiency of those organizations in pre- and post-privatization periods. The study finds the mixed results. In some cases, there is a clear evidence of an improvement in technical efficiency; in others there is no discernible impact of ownership on performance.

In the context of Pakistani privatization program, Aftab and Khan (1995) compared the pre- and post-privatization experience of five firms in three industries, where employees themselves and private firms purchased the units. The study finds that private sector firms are more successful than employees purchased ones, and in general, private ownership resulted in less labour retrenchment.

The study by Naqvi and Kemal (1997) analyzed the performance of privatized manufacturing industrial units of Pakistan in post-privatization regime and concluded: "[While] Pakistan has, by and large, completed the divestiture process in the manufacturing sector, it does not necessarily mean that this activity has been crowned with success judged by any known economic criteria. The effects of privatization on efficiency, output and the price level have so for been uncertain, and there is enough evidence to suggest that this policy may have lowered the economy's employment potential, worsened the conditions of workers and has led to greater concentration of income and wealth".

Similarly, Bengali (1998) analyzed the effects of privatization on seven privatized enterprises of ghee, automobile, cement and chemical industries of Pakistan. The author by using, simple ratio analysis concluded that firms, which were sold to employees, did not perform well compared to firms sold to parties with already industrial concerns.

Table 3.1: Early Stage Studies Focusing on Public-Private and Pre- and Post-Privatization Efficiency

Authors	Study Sector	Methodology	Results
i. Public-Private Efficiency Comparison Studies			
Koo (1985)	Commercial banks of South Korea	Case study approach	Unsuccessful. Government still regulates rates and directs credits.
Chishty (1985)	Jute textile mills	Case study approach.	Competition and resultant better performance from state-owned mills.
Sheikh (1985)	Ghee industry	Case study approach by using public profit and profitability supplemented by regression analysis with rigorous institutional detail	Firms under public ownership regime performed better than under private ownership regime.
Marshall (1986)	Banks, manufacturing and agricultural firms	Case study approach.	Rapid privatization made system more vulnerable to financial difficulty.
Foreman-Peck and Manning (1988)	British Telecom (B.T)	Comparison of B.T with that of five telecommunication elsewhere after privatization by using international comparison approach.	They conclude that B.T is apparently less efficient than telecommunication companies in both Norway and Denmark and more efficient than Spain and Italy.
Kapstein (1988)	Formerly private firms taken over by government when bankrupt	Case study approach.	Nova America-a successful, but little movement in traditionally state-owned sector.
ii. Studies Focussing on Public-Private Efficiency Comparison in Pre- and Post-Privatization Regimes			
Boardman and Vining (1989)	500 Non-US mining and manufacturing companies	Ratio analysis by using sales per employee and per assets after controlling for regulatory and competitive environment.	Private corporations are more profitable and more efficient.
Bishop and Kay (1989)	Shipping, airlines, gas, telecommunication, oil and automobile industries	Comparison of the privatized industries (given in column 2) with undivested enterprises in coal, rail steel and postal services in UK over the same period by comparing the employment, profit margin, revenues and TFP.	Most of the privatized industries have grown since privatization and grown more than those industries that have remained in public sector. While output and profit have grown, margins have increased, employment has declined.
Adam and Mistry (1992)	Industrial enterprises of eight developing countries	Case study approach by using quantitative and process analysis. The authors analyzed the pre and post- privatization performance of the same firms of eight developing countries.	Privatization improved profitability and efficiency.

(Continued)

Authors	Study Sector	Methodology	Results
Megginson et al. (1994)	Panel of forty-one enterprises from fifteen countries	Comparison of pre and post performance of divested firms in term of profitability, human resource utilization, enterprise growth and employment.	Strong performance improvements without lowering employment. Firms increased real sales, become more profitable, increased capital investment spending and improved their operating efficiency.
Galal et al. (1994)	12 companies from different sectors predominantly public utilities	A comprehensive case study approach. The authors used Cost-Benefit approach to analyzed the pre and post- privatization performance by taking into account the detailed institutional background of the particular firms, industry and overall country from which these enterprises belongs.	The study documents welfare gains in case of 11 out of 12 companies analyzed. They find no workers layoff, but in three cases significantly better off.
Aftab and Khan (1995)	Automobile and ghee industries	Simple ratio analysis of the divested firms in pre and post privatization periods.	The study compares private firms with employee owned firms after privatization. The conclusion is that private firms are more profitable than employee buyouts firms.
Bengali (1998)	Industrial enterprises from cement, automobile and chemical sectors	Simple ratio analysis with brief institutional characteristics of the enterprises particularly focussing on the labour issues after privatization.	Profitability and efficiency decreased for five out of seven companies, while solvency ratios showed a significant increase for three out of seven companies.
Mehdi (1998)	Industrial enterprises from automobile, ghee, cement, chemical and ceramics sectors	Simple ratio analysis with brief institutional details of divested firms.	The study analyzed the financial Performance of privatized firms in pre and post privatization regimes. It revealed both efficiency and profitability decreased after privatization.

Source: Compiled from:
Vernon and Lawrence (1989).
Megginson et al. (1994).
Galal et al. (1994).
Aftab and Khan (1995).
Bengali (1998).
Mehdi (1998).

3.3. Recent Literature on Ownership, Deregulation and Performance

Since the turn of the century, some significant effort has gone to evaluate the performance of firms in pre- and post privatization by using simple financial ratios as well advanced parametric methods such as stochastic production and cost function estimation and the subsequent derivation of production/cost efficiencies and productivity estimates. Some authors on the contrary used non-parametric methods such as data envelopment analysis (DEA) to address the issues concerning parametric methods. Following, I present some broader conclusions from a selection of some studies that had addressed the issue of performance under public and private ownerships. For the simplicity and to get a perspective on the business constraints, I divide the recent literature into different categories based on the nature of business (manufacturing, finance, transportation and utilities).

3.3.1. Manufacturing

Chirwa (2001) used DEA inter-temporal frontier for Malawi firms for the period 1970-97. This paper uses sample of 6 firms, 3 firms each from privatized and private category. His study found improved technical efficiency of privatized, state-owned and private ownership companies. The author suggested that competitive process is more effective than privatization in increasing the technical efficiency.

Saygili and Taymaz (2001) used stochastic production frontier on Turkish cement firms. This study covers the period 1980-95 encompassing nine years pre privatization period. Sample firms included are public, private and privatized and mixed ownerships. Study observed that privatization and change of ownership had no effect on technical efficiency.

Jones and Mygind (2002) evaluated the privatization effect in Estonia. Using a large random sample of 666 Estonian firms for the period 1993-97, authors estimated fixed effect production function. Based on different specifications, this study documented a positive effect of change of ownership. Private firms were more efficient and productive compared to state-owned firms. Study also separated firms based on ownership type and concluded that managerial owned firms are for more productive and domestic insiders the least.

Chirwa (2004) estimated stochastic production frontier using Malawian public, private and privatized firms during 1970-97. This study reported high mean technical efficiency in privatized, competing state owned and private companies. Competition, multi-nationality and structural adjustment process is more valuable than privatization in increasing the technical efficiency.

Bartel and Harrison (2005) looked at all Indonesian manufacturing companies (1981–1995) including private and public companies. The authors aimed to investigate whether reforms could replace full divestiture of public enterprises and due to the presence of agency problem, public sector manufacturing firms could be less effective. If both ownership firms were inefficient or efficient at a particular time, then environment in which public firms operate could be a significant determinant of productivity and efficiency. Study concluded that public sector enterprises (PSEs) perform worse than their private-sector counterparts. PSEs receiving government subsidy or shielded from import competition or foreign ownership performed worse than the private companies.

Brown *et al* (2006) carried out a study to determine the effect of privatization on multifactor productivity of manufacturing firms in Romania, Hungry, Ukraine and Russia. The authors estimated the long term effect of privatization by first introducing measures to control selection effect of privatization. This study documented an immediate and long term positive impact of privatization on productivity improvement for three countries (15% in Romania, 8% in Hungary, and 2% in Ukraine), but negative effect for Russia (-3%).

Okten (2006) evaluated productive and allocative efficiency of 22 Turkish privatized cement companies for the period 1983-99. Ownership change effects labour productivity. Allocative efficiency is dependent on changes in the competitive environment. All plants improved their labour productivity by reducing the work force. Plants privatized to overseas buyers also increase their capital and investment significantly.

Amess and Roberts (2007) evaluated the effectiveness of privatization on 2164 Polish producer cooperatives. They used parametric approach to estimate total factor productivity change. Their sample comprises of private and public enterprises over 6 years time span. They concluded that firms improved their productivity in the first three years of post privatization period by a range of 3-20%. These figures were 9-36% for labour productivity and -16 to 6% for capital productivity. They concluded that competition had forced firms to restructure and operate more efficiently.

Asaftei *et al* (2008) looked at the effect of ownership change and business conditions on the productivity of Romanian manufacturing firms during 1995-2003. The study concluded that ownership change is not sufficient to guarantee a better performance in term of productivity improvement. Competition plays an crucial role in forcing firms to become efficient in running the business. Fully private firms did well in a highly competitive sector, but this cannot be said for less competitive sector. Privatized firms did not perform any better than public enterprise. The study identified the role of institutional restructuring alongside privatization to boost productivity.

3.3.2. Financial Sector

Of those studies that have specialised in banking, there is a general trend indicating that deregulation has a negative impact on TFP. For example, an examination of the Tunisian banking sector by Chaftai (1997) revealed that TFP increased following the 1986 liberalisation program exercised by the country and concluded that, on average, banks were less efficient in the post-liberalisation period. These results were borne out by Grifell Tatje and Lovell (1996). Their study examined Spanish banking over the period of deregulation between 1986 and 1991, and concluded that TFP declined over that period.

Kumbhakar and Sarkar (2003) use TFP growth as the measure of banking performance over the period 1985-1996. Measures of output employed in this study include weighted values of financial figures, including deposits and investments. Labour and capital are the variable inputs, while equity and reserves are a quasi-fixed input. The study finds that there is a significant over employment of labour relative to capital, particularly in the public sector, both pre- and post deregulation and that the entire growth in TFP of private sector banks comes from the scale component.

Mendes and Reblo (1999) study the Portuguese banking sector, and illustrate that deregulation in that specific case did not lead to an increase in cost efficiency, but rather to technological regress.

Gilbert and Wilson (1998) use Malmquist indexes of productivity change to investigate the effects of privatization and deregulation on the productivity of Korean banks. The study finds that Korean banks responded to privatization and deregulation by substantially altering their mix of inputs and outputs, yielding large enhancements in productivity.

Fukuyama and Weber (2002) use panel data on Japanese banks over the period of 1992-1996, productivity growth is measured and decomposed into changes in output allocative efficiency, input technical efficiency and technical change. The study concludes that Japanese banks experienced productivity declines over the period of analysis and that each bank could have used somewhere between 78-93% of actual inputs if they had chosen the most efficient, revenue maximizing combination of outputs.

3.3.3. Transportation

Estache *et al* (2002) estimated total factor productivity of Argentinas and Brazil railways companies for the period 1994-99. Authors calculated productivity of operations before and after privatization. Study concluded improvement in productivity after privatization. Growth of TFP was due primarily to an improvement in output rather than reduction in input use.

Cullinane and Song (2003) estimated cross sectional production function frontier under different distribution assumption alongside panel data structure using Korean container terminal for the period 1978-96. Study concluded that privatization improved container productive efficiency. Involvement of private sector had a positive effect on efficiency.

Tongzon and Heng (2005) using stochastic frontier model looked at 25 container terminals efficiency. Study results showed private participation improved port operation efficiency and competitiveness. This study also accepted the premise that efficiency promotes competitiveness.

Cullinane *et al.* (2005) using DEA efficiency scores of worlds' leading container ports examined the effect of private participation on efficiency of ports operation for the period 1992-99. This study rejected the proposition that greater private sector involvement in the container port sector irrevocably leads to improved efficiency.

3.3.4. Utilities

Saal and Parker (2000) estimated multiple output cost function for the period 1985-99 using UK water and sewerage firms data. Study identified that economic efficiency improved post privatization. Overall, better regulation promoted economic efficiency rather than privatization.

Sall and Parker (2001) estimated productivity growth using quality adjusted output indices for the period 1985-99 using UK water and sewerage firms data. Study was unable to show any productivity improvement in post privatization period despite significant reductions in labour usage. Better financial performance was a result of growth in output prices.

Resende and Faceanha (2002) examined Brazilian telecommunication companies' efficiency using DEA frontier. The study period covered only two data points July 1998 and December 1999. This study documented evidence of decreasing returns to scale and no improvement in efficiency in post privatization period.

Li and Xu (2004) looked at the privatization and competition effect on telecommunication sector around the world for the period 1990 to 2001. The study concluded that privatization and effectiveness of competition had a positive effect on labour and total factor productivity. This article also distinguished the partial and full privatization effect on pricing and productivity and concluded that full privatization effect was also significant in raising productivity levels. These conclusions were robust to alternative model specifications.

Sall *et al.* (2007) studied the effect of privatization on privatized English and Welsh water and sewerage industry. This study used parametric stochastic frontier techniques to estimate total factor productivity alongside its components (technological change, efficiency change and scale change) for the period 1985-2000. This study period covers four years pre privatization and fourteen years post privatization. This study did not show any improvement in productivity due to efficiency decline, but showed a technical progress after privatization. The authors suggested that expansion of scale alongside a loss in efficiency might have contributed toward decline in productivity.

Rossi (2001) estimated the post privatization performance of 8 Argentinean gas distribution companies. This paper uses stochastic frontier method to estimate the efficiency in distribution of gas over 5 years. This study concluded that, as a consequence of shift in the frontier and catching up, efficiency improved in post privatization period for all firms in the sample.

It can be concluded that although there exists a vast body of literature on public-private efficiency comparison and privatization itself, but it lacks the consistency in results due to several reasons[13]:

i. Differences in market structure

Difference in market structure is the most important determinant of efficiency. Galal (1994) stated that studies which found private ownership superior has compared the competitive enterprises with monopoly. When reasonable competitive enterprises were compared, private enterprises dominated the public enterprises and finally when private and public monopolies were compared, results were ambiguous.

ii. Differences in variables used

Secondly, the indicators used to evaluate the performance of those enterprises have been the major factor for ambiguous results, where profit measure generally favors

[13] For detailed discussion and review of literature in this regard see Galal et al. (1994).

the private ownership's role, while, productivity measures are either biased in favours of public ownership or in most cases ambiguous for imperfectly competitive industries.

iii. Small number of observations

A third problem encountered in many case studies is the small number of firms being compared (single telecommunication company in a country). International comparison, in this sense, does not make sense because of geographical and economic differences of the countries.

Contribution of this study is that first, I cover at least five business cycles (26 years) of Pakistani cement industry which has evolved over time and has become significant in term of main export earner (Pakistan being the world's fifth largest cement exporter) and contribution to the national exchequer (30 billion Rupees tax contribution). Second, studies that addressed the issue of privatization/deregulation and firms performance since 2000 limit to either developed countries or countries at the advanced stage of their economic with relatively stable political system, established property rights and good industrial base. Pakistan being underdeveloped, having extremely low per capita income, political instability (5 times change of government since the first phase of the privatization program) provides compelling case and hopefully shall be a good case study when it comes to analysis of the effect of change of ownership on firms productivity and efficiency.

3.4. Methodological Issues

(a) Choice of Criteria: A Theoretical Analysis

How can one decide, whether firm i, in private sector is more efficient compared to firm j in public sector? or alternatively firm i or j is operating more efficiently at time t compared to t-1. What should be the appropriate criteria for efficiency measurement? The difference in objectives and constraints of public-private enterprise makes the comparison on the basis of some fixed criteria relatively difficult[14] . Private enterprises are usually set up for the accomplishment of set criteria of commercial profitability. The concept of public enterprises, however, implicitly assumes the existence of two dimensions that are enterprise and public dimensions. In the enterprise dimension's, the main objectives are production of some specific goods or services at competitive prices, marketing of output produced and documentation of transactions in the form of profit and loss accounts. The public dimension on the other hand, assumes the public interest as its prime objective.

In the literature discussed above, three types of indicators of public enterprise performance evaluation have been used. The details of each one with merits and demerits is given below:

- Private Profits and Financial Ratios: Most of the studies of the enterprise performance evaluation have used the private accounting profit or net income[15] . But private profit is generally criticized on the grounds that it

[14] See Sheikh (1985) for detail of choice of criterion for performance evaluation of a public enterprise.

[15] For example see Boardman and Vining (1989).

tends to suffer conceptual, pricing, attribution, accounting and distributional flaws, which render it, incapable of reflecting the true economic performance of a firm (see Figure 3.1). This is worked out by costs and benefits through prices which are either directly regulated by government or through indirect measures. So the relationship between input/output remains unclear. There have been developed some other indicators, which are based on taking into account the costs and benefits simultaneously, generally called financial ratios. Financial ratios do provide the base for performance evaluation[16]. Return on sale expressed in current prices can provide a powerful insight for the performance of a firm with relatively little effort. A historical comparison may lead to useful analysis with minimum efforts and expenditures. Financial ratios are, however, criticized, being of its static nature. Further, financial ratios calculation through private profits is criticized on the same grounds as that of private profits.

- Other Partial Indicators: Besides, private profits and financial ratios some authors have used the other partial indicators for efficiency measurement such as capacity utilization, physical unit of production and labour productivity etc[17]. These are partial indicators in the sense that labour productivity only describes the contribution of labour, while ignoring the capital efficiency side. Similarly, capacity utilization is based on some technological characteristics

[16] Financial ratios has been widely used indicators of performance in the studies so for conducted for privatised firms performance evaluation i.e. Bishop and Kay (1989), Magginson et al. (1994), Aftab and Khan (1995), Naqvi and Kemal (1997), Bengali (1998) and Mehdi (1998).

[17] Authors such as Koo (1985), Aftab and Khan (1995) had used such indicators.

such as, maximum possible output, which is a guess based on engineering characteristics of the plant. Some authors have used some other popular indicators based on the weighted average of some partial indicators. But in some cases these indicators tend to account for some benefits or costs more than once. While, ignoring some other benefits or costs entirely, thus, violating the generally acceptable definition, that benefits and costs should be counted once and only once.

Public Profits: Financial ratios and partial indicators of performance have been subject to severe criticism, due to the fact that they do not take into account the firm's social objectives adequately. The indicator, which addresses the flaws in private accounting profit, have been used is called public profits. The calculation of public profits at shadow prices can simultaneously take into account the commercial as well as non-commercial objectives of the enterprise. But, shadow prices are notoriously difficult to measure because of large data set requirement, institutional details and a significantly time consuming. There is, however, a short cut, which works fine in the cases where non-commercial objectives of public enterprise are less significant. Public profits expressed in current as well as constant prices can serve the task as underlined by public profits measured in shadow prices[18].

From the above discussion, it can be arguably concluded that starting point of performance evaluation should be financial ratios based on private accounting profit, expressed in terms of total sales or assets used. However, it should be supplemented by partial indicators of performance. Then, in the next stage, performance of the firms

[18] Authors such as Sheikh (1985) and Galal (1994) heavily relied on this type of criteria.

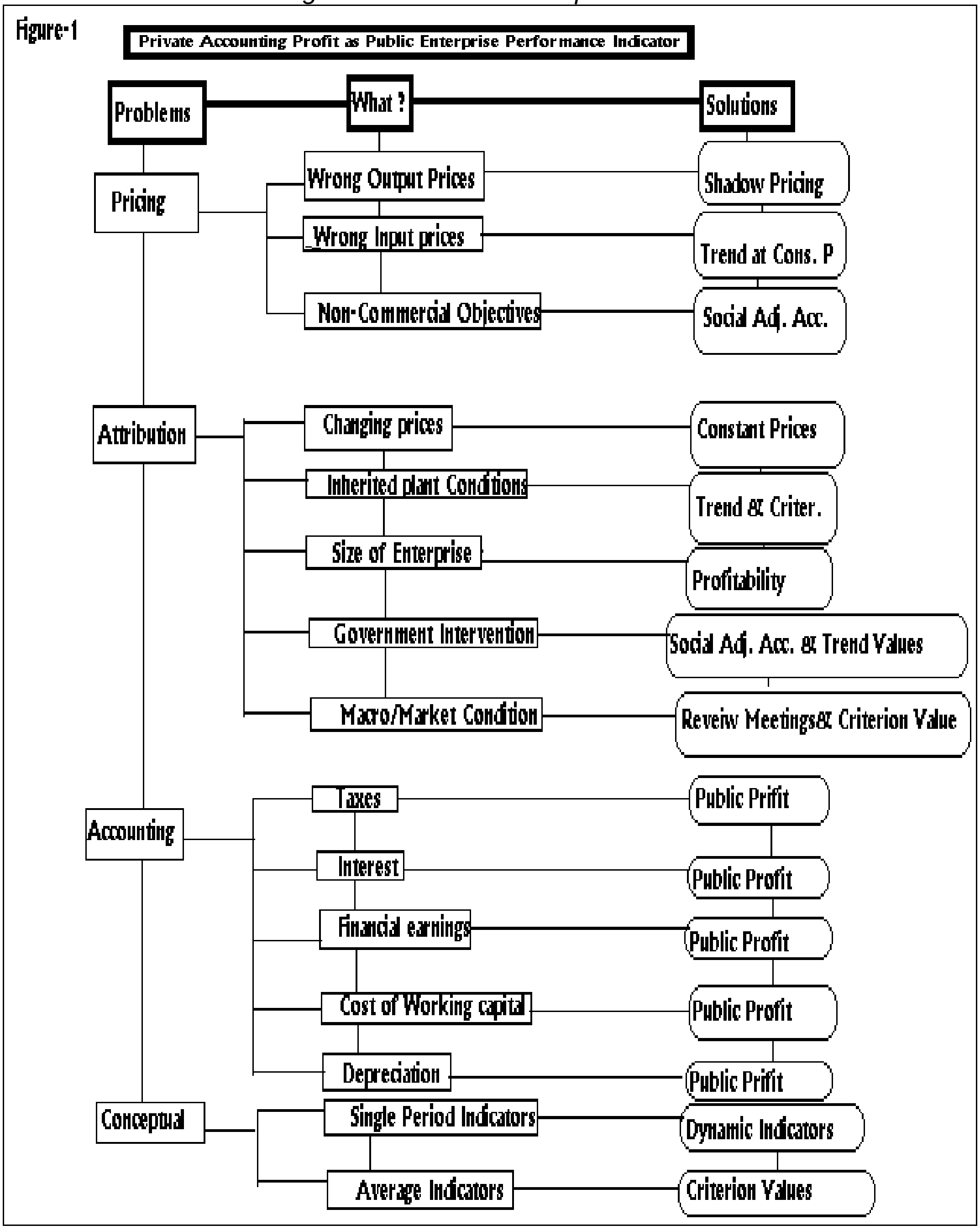
in fulfilment of social objectives should be analyzed by making adjustments in the private accounting profits. Once, it has been decided, that firm has done good or bad. The sources of differences in managerial efficiency over the time can be worked out. The overall managerial efficiency can increase due to the increase in one of the following kinds of efficiency:

1. Increase in technical efficiency is closely related to improvement in use of labour, fixed and working capital[19] as well as other inputs.

2. Increase in the price efficiency is closely related to cost efficiency or allocative efficiency, in which the factors of production are used according to the changing prices of inputs and outputs. This involves the estimation of cost efficiency component of managerial efficiency.

[19] For detail of discussion on sources of variations in efficiency, see Sheikh (1985).

Figure 3.1: Private Accounting Profit as Public Enterprise Performance Indicator



3.5. Choice of Criterion: My Preferred Methodology

In this section I outline my preferred methodology for answering the question: what happened as a result of public enterprise divestiture and its implications. To study the economic and financial effects and, to attribute the observed changes of that policy, I divide my sample firms into three categories:

(1) The “Treatment group firms” [privatized firms];

(2) The “Control group” [public sector firms until their eventual privatization]; and

(3) The “Neutral group” [private firms].

The treatment and control groups are different in the sense that one group was privatized and the other was not. Any observed differences could, with some justification, be largely attributed to privatization. I begin the analysis of each case by comparing the actual performance in post and pre divestiture regimes. I covered six years of public (pre divestiture 1986-91) and 20 years private (post divestiture 1992-2011) periods. The comparison of divested firms with group of firms either in public or private, working under the same economic conditions makes sense[20]. Fortunately, this option is open to us, as against many studies on post-privatization performance evaluation.

[20] Some authors have compared the performance of the same enterprise in post- and pre- privatization regimes and then attributed the observed changes to privatization. This approach, however, can be applied in a stationary situation. In the real world, however, policy may change and observed changes in performance could be driven by changes in economic policies rather than divestiture.

My approach to performance evaluation is divided into three subsections: The first part of performance evaluation takes into account the firms commercial objectives and is termed as financial performance evaluation (chapter 5). Second, that captures the non-commercial and distributional objectives, as economic performance evaluation (chapter 6). The former covers financial profitability and efficiency ratios. This includes profitability in terms of margins on sales and assets. Efficiency is tested in terms of financial soundness of the firm that covers the short time liabilities partial labour productivity indicators, investment growth and payout behaviour. In the second part, adjustments are made in private accounting profit and define the concept and methodology to calculate public profits and profitability and total factor productivity in current as well as at constant prices.

In subsequent analysis, I will discuss and estimate the technical and cost efficiency components of managerial efficiency. I also estimate a total measure of productivity that accommodates the growth in inputs and output and find sources of growth. I shall discuss the role of technological progress (regress) in productivity growth as well as the scale of operation and related scale efficiencies. This sort of analysis is necessitated due to significant additions in capacities in the last 10 years. Then I separately, estimate labour use efficiency to establish that golden handshake scheme imitated at the time of privatization has any bearing during later years. Finally, I estimate the extent of competition in pre and post reform period by jointly estimating demand and supply equation.

I believe that detailed analysis of such as mentioned above shall provide more complete picture in term pre and post privatization experience for the privatized firms as well as industry as a whole.

CHAPTER 4

Post Privatization Qualitative Assessment

This chapter provides information on the qualitative and quantitative adjustments made as a result of change of ownership and their impact on the day to day running of the privatized firms and their competitors. The chapter sources information by looking at the annual reports of the companies, interactions with the industry experts, producer association and consumers.

4.1. Introduction

Privatization wave of 1991/92 was a major reversal of the nationalization policy by the government. This was in part due to the fact that although lot of efforts were made to make the public sector enterprises effective and productive, no serious effort was made by the managers of these firms to run the organizations on commercial footing. One such effort in 1980s was the creation of a cell called 'Expert Advisory Cell' (EAC) under the ministry of industries and production to look after these enterprises and to devise mechanism to reward efficient managers. The Cell involved lot of international consultant and economists to evaluate the performance of these firms based on input use and productions achieved, financial strengths of the enterprise, achieving of goals set by the government in term of capacity utilizations etc and social welfare.

These consultants devised the statistical models, wrote down the programmes and trained local staff at the Cell to run those programmes. Based on those templates, EAC produced publications comprising of financial and operational data for general public, but at the same time graded these public sector firms in achieving those targets set by the Cell. This system remained in place for more than two decades but nothing concrete came out of this exercise. Public sector firms continued losing tax payers money in the form of subsidies.

The question is why this rewarding of efficient managers did not work to make these firms more productive and efficient and financially sound. To answer these questions, one would have to look at agency problem literature and this is beyond of scope for this chapter. Nonetheless, in 1991/1992, government started privatizing these units to private sector. The immediate impact of change of ownership in some cases was astonishing. These firms not only were financially restructured within a short period of time, but some extraordinary decisions were made to make these enterprises viable in the long run. In the following discussion, a qualitative assessment is made in term of change in management style, operational changes, and demand and supply constraints and how they were addressed by the new private sector management.

4.1.1. Changes in Operating Days

Before the privatization, public sector firms were usually operating with excessive and unnecessary pressure from labour union groups. The ultimate effect was less operating days, lower working hours and higher rent seeking from the labour unions. However, after privatization, the situation changed where the intensity of labour union pressure was now less due to job insecurity and better remuneration packages. As a result working hours and operating days improved.

Interviews with the new management of the privatized group of firms reveal that the new management paid greater attention to increase operating days by carrying out heavy repair and maintenance, better working environment and incentives[21] to the

[21] As D.G. Khan Cement company Chairman in his remarks in annual report of the company stated:
"I would like to ensure my employees that the new management is looking to creating more job opportunities for my staff and their families. Furthermore no retrenchment of job will be carried out, a concerned expressed by many privatised units".

permanent workers. Except Zealpak and Dandot where labour-management dispute forced a shutdown of the plant for a short while, overall management-labour relations were fairly stable. After privatization, production targets were stiffer, numbers of leaves were curtailed to the legal maximum and the extra leaves negotiated by the previous unions with public sector management were no longer honoured and non-pecuniary benefits were also eliminated. Result was higher working days and longer working hours.

A good example in this context is D. G. Khan Cement, where the record operating days were observed (see box-5.1). On the other hand, except Mustahkam Cement, all other public sector firms at that time period were operating as usual and in some cases even lower than the historical operating days of the company. The poor law & order condition of the country affected both types of ownership firms badly, but its intensity was higher in public sector firms because of union pressure and job security. On the other hand, privatized and private sector firms employees hesitated to enjoy these unscheduled holidays.

4.1.2. Modernization, Rehabilitation and Optimization Program

A company can produce more output from the existing plant by keeping it in a good working condition, so that it can be used at close to 100 percent capacity. The years of negligence in repair and maintenance services during the public sector ownership regime resulted in low capacity utilization, loss of operating days and the delays in committed supplies.

As soon as the cement industry was privatized, the monopoly of SCCP gradually got eliminated. The price war between private and state-run companies led to an urgent need of replacement of the relatively older kiln that has reached the expiry date, replacing with new, better, modern, and cost efficient and computerized dry process plants. Elimination of fixed price formula and rising prices of output provided the lubrication for the new management to opt for Building, Modernization and Rehabilitation (BMR) of existing operating fixed assets. Dandot and D.G. Khan Cement companies implemented this plan immediately after the transfer of ownership and remaining privatized firms except Gharibwal Cement implemented the BMR during 1993-95.

The results show that under BMR programmes, the companies immediately achieved productive and cost efficiency. However, it will take time to reap the full benefits of optimization program.

4.1.3. Management of Working Capital

Indirect effects of privatization such as better access to mobilization of resources, and enough input-output inventory stocks for windfall gains in the period of uncertain demand are numerous. Shaikh (1985) estimated 6.5% improvement in technical efficiency of working capital in case of private ownership period for ghee industry during 1970-71

The building of sufficient working capital is important because of the fact that in case of default on payment of public sector firms, state usually intervenes and rescues the firm from ceasing production operation. Private sector firms do not enjoy such benefits. The quantity of working capital of the privatized firms improved immediately after privatization. This ensured the new management for better competition in input market with the public firms that enjoyed a support from the state-owned institutions and corporations like WAPDA for electricity, Sui Northern and Southern Gas for gas and Pakistan State Oil (PSO) for furnace oil purchase.

4.1.4. Competition

The most important consequence of liberalization and privatization is certainly the expected increase in competition among the firms. It provides the base for efficiency improvement. A significant increase in investment spending for capacity expansion and maintenance was necessary for the privatized firms to compete in new competitive environment after change of ownership and withdrawing of subsidies and this is what they did. On the other hand, those firms which were not privatized in 1991/92, still kept relying on government finances. Tight fiscal policies and ultimate withdrawal of subsidies had little room for modernization of these public firms after 1991. The uncertainty of privatization of these units also kept them away for easy mobilization of resources from stock market. The ultimate effect of that policy was relatively older plants, cost inefficient production process, lack of incentives and real threat of privatization for this group of firms. They have to face a stiff competition from powerful private and privatized firms in every sphere of activity ranging from production to marketing. So, in a nutshell, the period of 1993 to 2002 saw a developing competition among public, private and privatized firms

4.1.5. Trade Policy and Protection

With the nationalization of cement plants in 1972, both internal and external trade in cement became a state monopoly. In 1976, Pakistan became net importer of the cement. The powers to import the cement were delegated to SCCP. In July 1981 the private sector was authorized to import cement without any restriction, and in 1985 government removed the SCCP right to import. With the beginning of 1990s the government initiated a phase program of tariff reforms. As a result, excise duties and nominal protection have been lowered[22]. This brought for-reaching effect on healthy competition in overall industrial activity as well as cement industry from the international competitors.

4.1.6. Capital Requirements

Capital requirement for setting up a cement plant is high. According to APCMA estimates, the average cost for setting up a grass root cement plant is around Rs.1500 per ton of clinker as of 1988 prices. On this basis, a million-ton plant would require about Rs.1500 millions. Further, with the increase in marketing cost and distribution network due to competition, it became necessary for the manufacturers to extend better credit lines to the distributors. This has further raised capital requirements in the industry. The necessity for installation of captive control equipment to check dust

[22] The cement industry of Pakistan has been subject to custom duties. It was initially subject to tariff of Rs.550 per ton and import surcharge of 10% of the CIF prices. In January 1982, the tariff was raised from 10% to 25% as well as the imposition of extra surcharge of 5%. The tariff was again raised to 40% in January 1983 and 70% in June 1984.

emission and installation of captive power generators to overcome problem of power shortage, have also raised the capital requirements. Therefore, the large financial resources are required for installing cement manufacturing facilities, which can be considered as a barrier to entry. But the strategy adopted by government during 1980s has worked positively[23]. This strategy has made the entry conditions relatively easy, which, translated into new entrants and resultant competition in 1990s.

4.1.7. Capacity Utilization

The rising demand does not ensure the higher capacity utilization which could lead to economies of large-scale production. The older kiln did not have the ability to work as efficiently as new modern dry process plant. In this case, higher capacity utilization may result in higher maintenance costs and some time it can offset the increase in profit due to economies of scale. Despite rising demand, the management may opt to remain at sub-optimal level of production if they face such situation. Private and privatized group of firms invested highly in technology upgrade and maintenance and achieved higher capacity utilization and in some cases exceeded the rated capacity (see box-1) immediately after privatization against the dismal performance in term of capacity utilization by their competitor public sector firms (firms still operating under public ownership).

[23] During this period government introduced significant changes in the prudential regulation. These include the change of debt-equity ratio and underwriting procedures.

Box-1: Director's Opinion towards Performance after Privatization

- "With the blessing of Almighty Allah and the efforts of officers and workers of the company I have been awarded with success i.e. achievements of historic highest production. Clinker and cement production and dispatches records are as clear as crystal from following figures.

	1993	Previous Record
Clinker Production (ton)	663431	622836 (1990)
Cement Grinding (ton)	685400	692861 (19887)
Dispatches (ton)	683142	608364 (1987)

The production figure achieved for clinker, cement grinding and dispatches have not only excelled the budgeted targets by substantial margin but set new records in every sphere of activity. The plant was operated for 326 days which is also a record".

Source: Director's Review, D. G. Khan Cement, Annual Report, 1993 and 1996.

- "It is gratifying for us that during the year the company achieved the highest ever production results".

Source: Director's Review, Gharibwal Cement, Annual Report, 1995.

- "I may point out that the production of clinker and cement was highest ever in the history of company".

Source: Director's Review, Mustehkam Cement, Annual Report, 1993.

- "In the year under review company achieved highest production record on the basis of only five kiln operation".

Source: Director's Review, Zealpak Cement, Annual Report, 1992.

- "The report under review is the first complete year of operation under the new management after privatization. I am pleased to report that the clinker production, cement sales and profit of the company during the year were highest ever achieved in the history of company".

Source: Director's Review, Dandot Cement, Annual Report, 1993.

- "Yours directors are pleased to inform you that the company had produced 110% rated capacity of cement in 1990 and this year 123% of rated capacity. It is not out of to mention here that at the time when project was initially started, the GOP had assured 20% return on equity capital. Hence Dadabhoy opted sub-optimal plant having a capacity of production 1000 metric tons per day. After deregulation of cement prices and with-drawl of government assurance on 20% return on capital, it become obvious that the project without optimization was not viable".

Source: Director's Review, Dadabhoy Cement, Annual Report, 1991.

4.1.8. Threat of Bankruptcy

The bankruptcy chances are multiplied by the depressed demand and stagnant economic activity. As mentioned earlier, the real threat of bankruptcy was a powerful challenge for a new management after subsidies were removed as a result of privatization of these firms. D.G. Khan Cement director's report stated: "At present cement industry as a whole is moving toward decline in earnings growth as competition increased with the advent of extra capacity. This means that I am heading toward the survival of the fittest, that is, the most efficient plant will survive in the high competitive environment". In the backdrop of these conditions, privatized firms opted for technology upgrades to survive in the long run.

4.1.9. Low Cost of Excessive Employment and Extra Benefits

Immediately after privatization the new management took some extra measures to curtail the wage bills. All the extra benefits which new management considered illegal were withdrawn. Employees who obtained the "golden handshake" have been re-employed on contract basis, now they are working at much lower wage rate than earlier, having no extra-benefits such as, leaves, medical facilities, holidays, pension etc. The strategy played a dual role in lowering costs and employing the most efficient workers among the workers who opted for golden handshake.

4.1.10. Costs and Economic Viability of the Industry

Over the years, Pakistan remained an economic producer of cement[24]. In the past, cement plants derived their cost advantages from cheap natural gas, low wage rates and low financial cost of the old wet process plants. But, in recent past, increasing maintenance costs and substitution of fuel oil for low-cost natural, gas, rising cost of electricity and furnace oil, and constantly increasing price of paper and labour charges have eroded these comparative advantages. Furthermore, the elimination of transportation costs and massive increase in indirect and direct taxation has reduced the retained price. As a result, trend has been changed in cost advantage. All these factors have contributed significantly in efficient use of resources over the time[25] .

4.1.11. Other Exogenous Factors

Political will is the most important factor for industry growth. Since 1992, successive governments have kept the privatization, liberalization and deregulation policy on their political agenda. The fear of policy change in the near future is almost nonexistent

---

[24] Based on the fact that calculated domestic resource cost is well below one. Also by the fact, that industry has generally received negative effective protection (for details see World Bank (1985).

[25] The price of furnace oil and electricity charges almost doubled to Rs.5868 from Rs.3843 in 1994. Similarly, electricity tariff was Rs.2.13 per unit in 1994, which surged up to Rs.3.06 per unit in 1996. In 1995, the cost of manufacturing one bag of cement was calculated at around Rs.56, made up of Rs.23 for cost of furnace oil, Rs.21 for electricity and Rs.12 for the cost of paper. Adding up Rs.90 worth of taxes, a sum of Rs.29 was left with the manufacturers to cover the costs of raw material, labour, stores, depreciation, financial costs and all overheads. They used to save Rs.60 per bag, excluding taxes to enable them to cover all the above mentioned overheads.

because of internal and external macroeconomic pressures. This has encouraged competition in the private sector, which could have helped firms in achieving efficiency and growth in productivity.

CHAPTER 5

Financial Performance

This chapter is devoted to the analysis of industry performance based upon purely financial indicators and proxies in pre- and post privatization periods. Industry and individual firms' performance is assessed with the use of profitability, solvency and efficiency ratios. Simple and widely used non-parametric techniques are used to see any statistical difference in the value of these ratios in pre- and post privatization periods. Subsequently, these ratios are used in the regression framework to find out the determinants of profitability, efficiency, output and capital investment.

5.1 Introduction

Since the widely cited work of Megginson *et al.* (1994), an overwhelming number of authors had used financial ratios to assess the impact of privatization on the financial and operational performance of the firms[26]. These studies had not been just limited to developed economies, but recently, a significant number of researchers have started using the similar methodology to evaluate pre- and post privatization experience of privatized firms in developing and former socialist countries. Some widely cited studies in this regard include: Megginson *et al.* (1994), Villalonga 2000), Harper (2001), Boubakri and Cosset (2002), Jackson *et al.* (2003), Wei *et al.* (2003), Boubakri *et al.* (2004), D'Souzaa *et al.* (2005), Boubakri *et al.* (2005), Chen *et al.* (2006), Mathur and Banchuenvijit (2007), Farinós *et al.* (2007), Naceur *et al.* (2007), Cook and Uchida (2008), Huanga and Yao (2010), Huang and Wang (2011), and Zhang *et al.* (2012).

The reasons for the popularity of this type of analysis are that ratios are simple to understand, intuitive and easy to implement. Some commonly used financial ratios include: return on sales/investment, value of real output, investment as a % total assets, cash ratios and dividend payout. These ratios are considered as a good starting point but insufficient to paint a complete picture as well as issues with different accounting standards across the globe which makes international comparison difficult. Hence, this chapter is dedicated for simple financial analysis with the aid of financial

[26] The popularity of using financial ratios could be gauged by the fact that Megginson *et al.* (1994) study has been cited in more than 1300 research pieces worldwide.

ratios and then these ratios are used to econometrically model the determinants of profitability, efficiency, investment and output growth.

5.2. Testable Hypothesis

All the governments opting for privatization expect that this policy would result[27] in the following changes in post privatization period.

i) Increase in profitability of the firm

State owned enterprises are often chronically unprofitable, at least, in part, because they are, often charged with objectives such as, maximizing employment and developing backward regions. These social objectives are obtained by giving a soft bribe to public sector managers in the form of subsidy to compensate for operating losses and provision of inputs at reduced prices. Privatization is designed usually, to achieve single most important objective of getting firms commercially profitability. It is, therefore, assumed that strict monitoring of financial markets, penalization to inefficient managers and clear-cut signals of no further subsidy, would work. The immediate threat of bankruptcy would also force the new management to accelerate commercial profitability for the long term survival.

Many ratios can be used, as proxies of profitability measures. In this chapter, I use two types of profitability ratios: profit margin ratios, including gross, operating and net return on sales, return on assets and equity employed.

[27] For detail description of government expectation toward privatized firms and ratios, this represents these objectives see Megginson (1994).

ii) Increase in operational efficiency of the firms

By selling public enterprises to private owners and letting them to face competition, one would expect that firms will employ their human, financial and technical resources more efficiently. By removing non-economic objectives from state-owned–enterprises (SOEs), government expects an increase in operating and financial efficiency; maintain enough liquidity in its portfolio to meet the daily expenses and financial charges. Similar to profitability measures, many ratios could be used as a proxy for efficiency. I use five ratios in this chapter to evaluate firms operating efficiency. These include labour productivity, capacity utilization, interval measure; average collection period and inventory turnover.

iii) Cause the firms to increase their capital spending

It is believed that the public sector firms may invest more as compare to private sector firms, as the former are the principle vehicle of investment for government. Boycko et el. (1993) also suggested that government should be willing and able to subsidize inefficient high output in SOEs, in order to maximize employment or to achieve socially desirable non-economic goals. But in my case I expect that investment spending in public sector firms will be lower due to two reasons:

a) Already large-scale public sector development program;

b) Tight budget constraint imposed by government as an effective tool of controlling these enterprises.

I expect that privatized firms will increase investment spending because of greater access to private debt, especially from equity market. Two proxy ratios are computed to measure the investment intensity; capital investment to sales (CAPSAL) and capital investment to total assets (CAPAS).

iv) Increase in output of the firms

Government hopes that better incentives and flexible financing opportunities will increase real sales after privatization. However, another competing hypothesis is that, ending of subsidies could cause a decrease in production relative to pre-divestiture period. I will test this prediction by using inflation-adjusted sales in pre and post-privatization regimes. For this purpose, I compute inflation adjusted sales volume.

v) Improvement in solvency and liquidity position

Governments usually do not pay attention on financial soundness of firms. I expect that after privatization, leverage ratios will decline because traditionally SOEs had high debt level, at least in part, because the firms would not sell equity to private investors and the only source of funding is retained earnings and capital injections by government. For measuring the intensity of hedge against financial insolvency of the divested firms, I use ratios, such as, cash ratio, working capital ratio, net worth relative to total liabilities ratio, inventory turn over time, debt-equity ratio and the time interest earned.

vi) Improvement in dividend pay-outs of the privatized firms

Tough competition ensures, at least theoretically, that privatized firms will improve their track record of low dividend payout. This may be due to enough surplus generation for dividends payouts. I examine the dividend pay-out pattern by using two proxy ratios measured as, total cash dividend relative to net income (PAYOUT) and total cash dividend relative to net sales (DIVSA).

Given these objectives, summary of testable predictions of profitability, operating efficiency, capital investment spending, output, leverage and pay-out are given in Table 5.1. These predictions are less likely to be mutually exclusives because firms changed behaviour is less likely to be limited to one element of their behaviour. To test my predictions, first I compute empirical proxies and then, use Wilcoxon Signed Rank test as my principal method of testing for significant change in post privatization period over the public ownership period. This procedure will test whether, the median difference in proxy value between pre-and post-privatization period is zero. I base my conclusion on standardized test statistic, which follows normal distribution[28].

[28] As the number of observations exceed 30 in most of the cases discussed.

Table 5.1: Summary of Testable Hypothesis

Financial Indicators	Proxy Ratios	Computed As:	Testable Hypothesis
Commercial Profitability	i) Return on Sale (ROS)	i) Net income[a] ÷ Net Sales[b]	i) $ROS_{pri} > ROS_{pub}$
	ii) Return on Equity (ROE)	ii) Net income[a] ÷ Net Equity[c]	ii) $ROE_{pri} > ROE_{pub}$
	iii) Return on Investment (ROI_1)	iii) Net income[a] ÷ Total Assets[d]	iii) $ROI_{1pri} > ROA_{1pub}$
	iv) Return on Investment (ROI_2)	iv) Gross Profit[e] ÷ Total Assets[d]	iv) $ROI_{2pri} > ROA_{2pub}$
	v) Operating Profit Margin (OPM)	v) [Gross Profit[e] - Operating Exp.[f]] ÷ Net Sales[b]	v) $OPM_{pri} > OPM_{pub}$
	vi) Gross Profit Margin (GPM)	vi) [Gross Profit[e] + Depreciation] ÷ Net Sales[b]	vi) $GPM_{pri} > GPM_{pub}$
	vii) Net Profit Margin (NPM_1)	vii) [Gross Profit[e] – Operating Exp.[f] - Taxes[g]] ÷ Net Sales[b]	vii) $NPM_{1pri} > NPM_{1pub}$
		viii) [Net Income[a] + Depreciation] ÷ Net Sales[b]	
	viii) Net Profit Margin (NPM_2)	ix) [Gross Profit[e] – Operating Exp.[f] + Depreciation] ÷Financial Exp[h].	viii) $NPM_{1pri} > NPM_{1pub}$
	ix) Time Interest Earned (TIE)		ix) $TIE_{pri} > TIE_{pub}$
Commercial Efficiency	i) Net Income Efficiency (NIE)	i) Net Income[a] ÷ Number of Employees[i]	i) $NIE_{pri} > NIE_{pub}$
	ii) Sales Efficiency (SE)	ii) Net Sales[b] ÷ Number of Employees[i]	ii) $SE_{pri} > SE_{pub}$
	iii) Capacity Utilization (CAPUT)	iii) Actual Production ÷ Production Capacity	iii) $CAPUT_{pri} > CAPUT_{pub}$
	iv) Interval Measure (IM)	iv) [Cash[j] + Short Time Investment[k]] ÷ Financial Exp.	iv) $IM_{pri} > IM_{pub}$
	v) Inventory Turn over (ITO)	v) Cost of Good Sold[l] ÷ Average Inventory[m]	v) $ITO_{pri} > ITO_{pub}$
	vi) Average Collection Period (ACP)	vi) Average Recieveables ÷Average Daily Sales[o]	vi) $ACP_{pri} > ACP_{pub}$
	vii) Depreciation To Sales (DEPNS)	vii) Depreciation Cost ÷ Net Sales[b]	vii) DEPNSpri > $DEPNS_{pub}$
Capital Investment	i) Capital Expenditure to Sale (CES)	i) [Fixed $Assets_t$ – Fixed $Assets_{t-1}$] ÷ Net Sales[b]	i) $CES_{pri} > CES_{pub}$
	ii) Capital Expenditure to Assets (CEA)	ii) [Fixed $Assets_t$ – Fixed $Assets_{t-1}$] ÷ Total Assets[d]	ii) CEApri > CEA_{pub}
Output	i) Real Sales (RSALE)	i) Gross Sales[p] ÷ CPI[q]	i) $SALE_{pri} > RSALE_{pub}$
Leverage (solvency & bankruptcy)	i) Cash Ratio (CR)	i) [Cash + Short Term Investment[k]]÷ Current Liabilities	i) $CR_{pri} > CR_{pub}$
	ii) Working Capital Ratio (WCR)	ii) [Current Assets – Current Liabilities] ÷ Current Liabilities	ii) $WCR_{pri} > WCR_{pub}$
	iii) Inventory Turn Over of Time (ITOT)	iii) Net Sales[b] ÷ Average Inventory[m]	iii) $ITOT_{pri} > ITOT_{pub}$
	iv) Net Worth To Total Liabilities (NWTL)	iv) [Total Assets[d] – Current Liabilities] ÷ Total Liabs.	iv) $NWTL_{pri} > NWTL_{pub}$
Pay-out (distribution of surplus)	i) Dividend to Sale (DIVSAL)	i) Cash Dividend ÷ Net Sales[b]	i) $DIVSAL_{pri} > DIVSAL_{pub}$
	ii) Dividend to Income (DIVNPT)	ii) Cash Dividend ÷ Net Income[a]	ii) $DIVNPT_{pri} > DIVNPT_{pub}$

Notes: Subscript pri stands for private ownership and pub for public ownership.

a. Net profit after tax.
b. Gross sales-indirect taxes
c. Total net equity
d. Total current assets
e. Net sales-costs of good sold
f. Selling, general and administrative expenses
g. Direct taxes
h. Interest payment on long and short- term loans
i. Total number of employees
j. Cash-in-hand
k. Investment in associated companies and stocks
l. Including raw material, fuel and energy, labour and other misc. costs
m. Including average of start and end of year input-output inventory.

5.3. Profitability Results

One of the objectives of privatization has been to make firms profitable to cover their financial expenses as well as being able to make new investments. The purpose of this section is to explore that whether this objective has been achieved for privatized cement industrial units. Results of the profitability ratios show a one-time upward movement immediately after a stagnant trend in profitability ratios in pre-divestiture period for divested companies, followed by a decline in all profitability ratios during 1995-99. However, the decline in profitability ratios during this period has not been limited to privatized firms, as the overall industry followed the same trend.

There are a number of proxy ratios that serve as a profitability measure. However, two types of profitability ratios are used in this study: profit margin ratios and return on assets or equity employed. Profit margin ratios measure the firm's ability to control expenses relative to sales, while, return on equity (ROE) and return on assets (ROA) measure the firm's ability to use its assets and equity profitably. I use different alternative profitability measures in my study to keep the results robust irrespective of choice of measure. However, I mainly concentrate on the ratio of return on sales (ROS) as a principal measure of profitability. This ratio is less affected from inflation and accounting techniques, because it is expressed as a current rupee measure of flow.

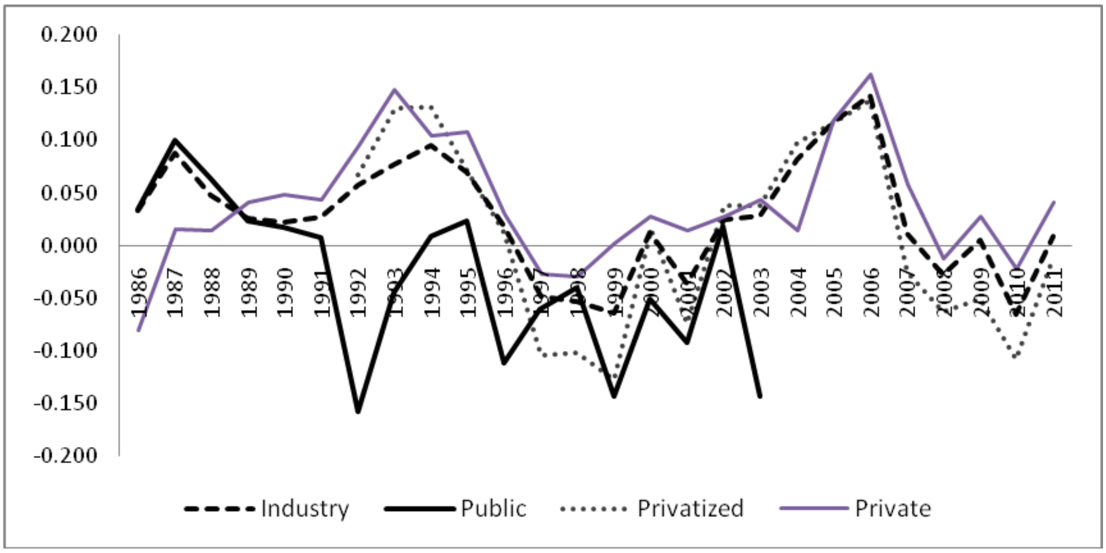
5.3.1. Net Profit Margin (NPM)[29]

Net profit margin (NPM) is comprised of three alternative financial ratios: return on sales (ROS), return on sales excluding other income (NPM1) and return on sales including other income and depreciation (NMP2). The NPM defined as net income divided by total net sales relates after tax profit to sale and reflects management ability to generate enough resources to recover the firm's manufacturing, operating as well as borrowing costs while, also giving owners a reasonable rate of return on their investment. First, return on sales improved initially for all types of ownership firms as well as overall industry average (see Figure 5.1). Then, again, industry witnessed a significant boom during 2004 to 2007 accompanied by another decline in profitability during 2008 to 2010. Again, irrespective of ownership, all firms behaved in a similar way. This may be an indication of cyclical behaviour rather than ownership per se. However, all those firms who could not be privatized in 1992 did not do well compare to firms started as a private or privatized companies. However, overall, I am unable see the differences in ROS between two periods (pre- and post privatization).

On the average (median), industry witnessed a decrease in ROS post 1992. Private group firm's margin was high relative to other ownership in post 1992. Public sector firm performance on the other hand, did not improve after 1992 privatization policy.

[29] I mainly discussed the results of profitability by using net income as a numerator.

Figure 5.1: Cement Industry Profitability: Return on Sales (1986-2011)

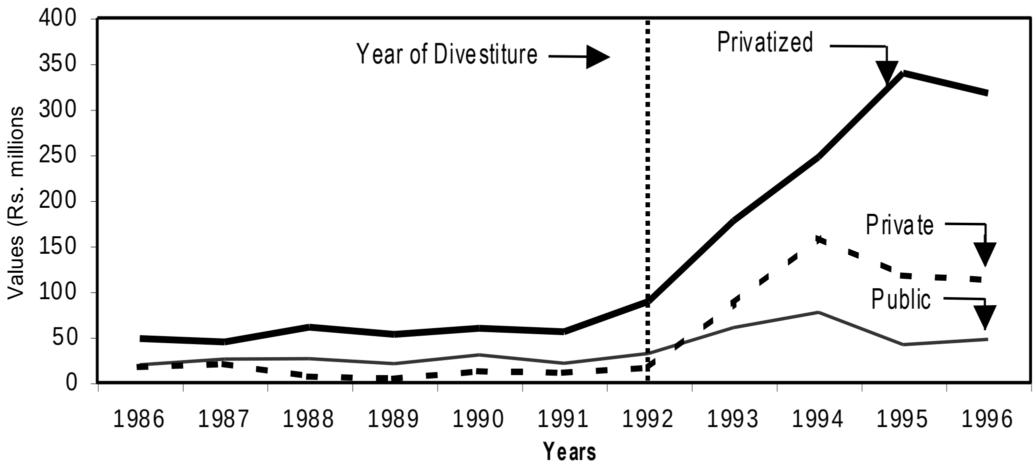


What about, return on sales excluding other income and then including both other income and depreciation? The results are robust after using these modified measures and returns one sale declined for all ownership firms in post 1992 period.

In case of a private firm, the power to set the level of working capital is almost delegated to chief executive officer (CEO) by the shareholders and the board of directors. The assumption is that the manager will keep as much working capital as necessary for efficient operation, since the funds have alternative uses and can generate income directly. In economic term, with given autonomy, managers would require working capital only up to the point where marginal cost equal to marginal revenue product. The profit of the firm may be directly influenced by the correct decision made by managers regarding the optimum amount of working capital. The management efficiency can be judged on the basis of profit which, will rise or fall according to the correctness of the decision on the level of working capital. The management might divert funds to more productive uses by keeping level of inventory and cash at the point which ensure smooth operation of the firm. A public sector manager, with little autonomy, regarding decision of necessary working capital may find himself with extra or lower working capital compare to actual optimal requirement.

After privatization, the new management of privatized firms adopted an aggressive strategy of investing the money in different activities[30]. Other income growth which was in the range of 4-5% during 1986-91 for these companies jumped to 42% during immediate period of post privatization 1993-96 (see Figure 5.2). This explains the variations in the profitability results in term of return on sales initially going up and then declining, making overall effect not significant.

Figure 5.2: Other Incomes of Firms by Type of Ownership (1986-96)



[30] As explained in the political economy of privatization of cement industry, units were sold to the buyers already running business in different fields including cement industry. The new management kept the cash money in their other businesses and earned a reasonable rate of return.

The funds can be invested:

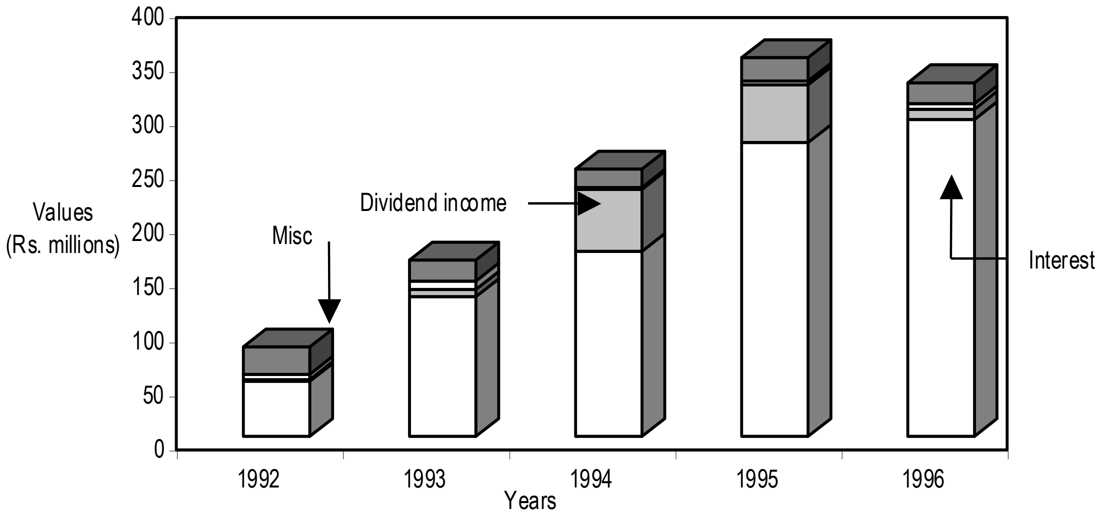
i) in stocks and earned the capital gain or dividend.

ii) keep the cash in bank deposits in both form of time and demand deposits and earned a fixed rate of return.

iii) investment in miscellaneous activities.

The management decision to invest depends on the expected revenues from the asset (security). With the exception of some blue chips companies, dividend in Pakistan has not been paid regularly and is subject to withholding taxes[31]. Then, the only other reliable source of income is the second category. The new management kept the money in time and demand deposits and earned a reasonable rate of interest (see Figure 5.3) during 1992-96 generally and 1994-96 particularly.

Figure 5.3: Privatized Firms: Break-up of Other Income (1986-96)



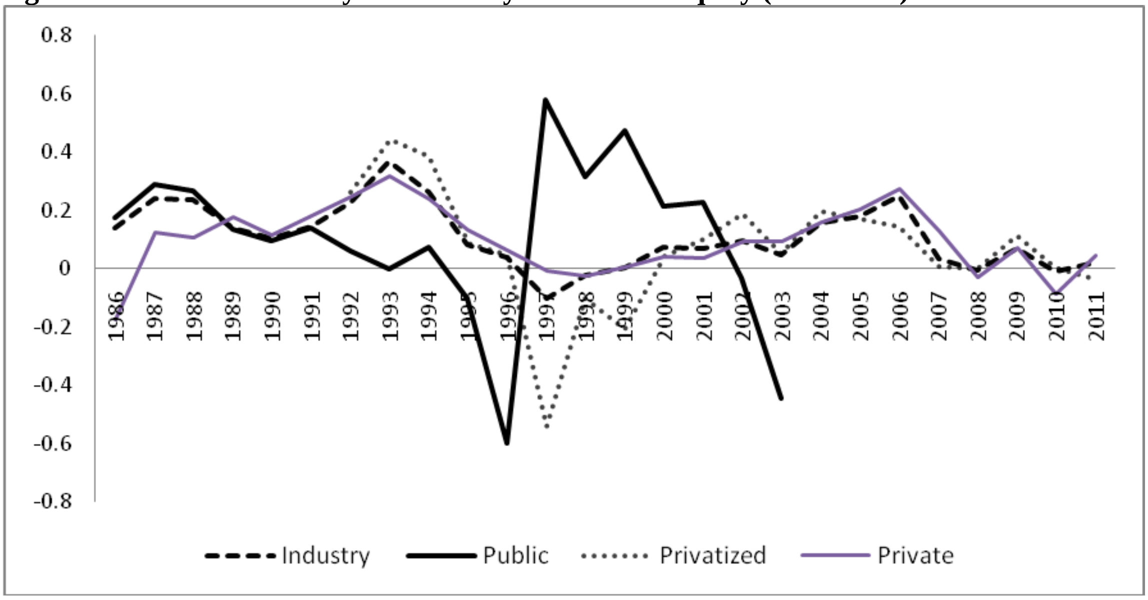
[31] I will discuss this issue later on in the dividend pay-out pattern of privatized firms.

5.3.2. Return on Equity (ROE)

ROE defined as net income divided by total net equity expresses the rate of return on shareholders' equity and measures the management performance. A higher ROE is associated with effective management control as well as overly leveraged firm. Low ROE indicates a sign of ineffective management as well as conservatively financed firm. This ratio has vital importance to the owners and shareholders because it shows the return on their investment.

Similar to ROS, return on equity (ROE) improved significantly immediately after privatization for private and privatized group against a decline for public sector group of firms (see Figure 5.4) in post privatization period. It remained flat during 2000 to 2004, increasing subsequently during 2005-2007 and then declining. The maximum increase has been for private firms of 8.5% followed by privatized firms (2.9%) as against industry average of 2.4% during 1992-96. However the increase/decrease are statistically insignificant for all ownerships. Privatized group firms, in pre privatization period earned a reasonable rate of return on government equity (20%) which is better than very attractive saving schemes introduced by different financial institutions and commercial banks and even higher than average return on stocks (e.g. Karachi Stock Exchange rate of return on stocks remained 17-18% during 1992-96). After privatization this ratio however, improved to more than 23%. Public sector firms on the other hand, with conservative financial structure although enjoyed a positive ROE, peaking to 20% during 1987-88, but then declined afterward. In 1992-93, this ratio showed a roughly 6% decline. The decrease may be due to lower sales or increase in taxes or operating expenses etc. The first reason does not seem to be realistic as these companies achieved an increase in return on sales. The increase in equity is the next alternative source of decline as compared to income during 1993-96. But due to dependence on government, probability of fresh funds injection could be ruled out.

Figure 5.4: Cement Industry Profitability: Return on Equity (1986-2011)



5.3.3. Return on Assets (ROA)

Third measure is return on assets (ROA) or investment (ROI), defined as net income divided by total assets. The return on total assets focuses on earning power of ongoing operations. The decline in ROI shows that the firms' ability to employs its asset effectively is deteriorating. The decline may also reflects such factors such as incremental investment in fixed assets[32] , the lower assets turnover ratio, higher interest expenses etc. I use three alternative measure of return on investment. First

[32] The rupee invested in time t may take time to earn a reasonable rate of return at time t+1, t+2, and so on.

ratio (ROI1) is net return on investment, second is net profit before direct tax divided by total assets, and third ratio is gross return on investment.

As explained in next sections, the privatized firms pursued an aggressive policy of capital-investment spending, causing a decline in rate of return on investment for this group of firms (see Figure 5.5), whereas, private firms showed a significant increase in the return on investment in post reform period.

Figure 5.5: Cement Industry Profitability: Return on Assets (1986-2011)

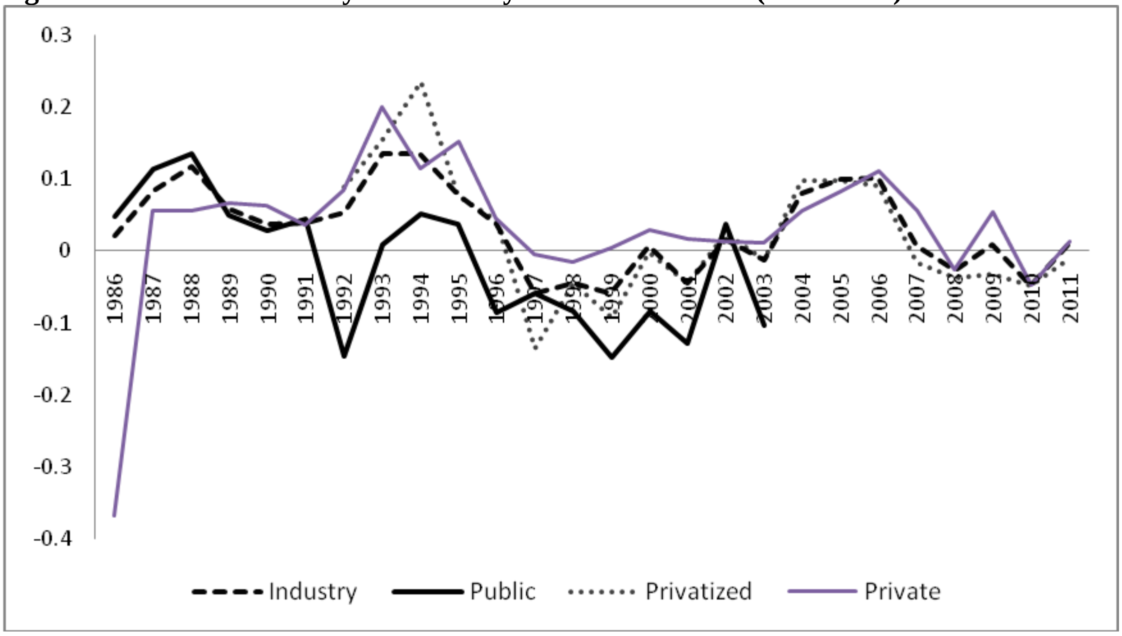


Figure 5.5 shows the trend of ROI in the cement industry during the sample period (1986-2011). The trend is same as in case of ROE and ROS. By using some other alternative profitability ratios, broadly speaking I could arise at the same conclusion (see Table 5.2). By looking at other alternative measure of profitability, broadly speaking I could arrive at similar conclusions

When firms are grouped according to the process of production and by location, following conclusions could be made:

Dry process firms outperformed the wet and semi wet process firms due to cost efficient nature of dry technology. Return on sales; return on investment and net profit margin all increased significantly during 1993-96 compared to 1986-91 but then declined in subsequent years. Dry process firms are relatively new and needs higher investment and equity. This leads to lower return on equity in the initial years of operation. Return on equity has been higher for other process firms compared to dry process firms. When firms are grouped according to location, north zone firms earned higher profit margin compared to south zone firms. The difference was clear even in pre privatization regime and, the reforms policy did not change the trend.

Summary of Commercial Profitability: The upshot of the profitability discussion could be summarized as: after privatization gross and operating profit margin of privatized companies increased immediately and had been higher than public sector group firms and comparable private sector group firms. But, later on, margins declined during 1996 to 2003, raised again during 2004 to 2007 and then decline after 2007. Immediately after privatization, new management used cash reserves wisely and earned a reasonable rate of return in terms of other income. By adding other income component, the margins on sales, equity and investment of privatized firms has been comparable to private sector group firms. The decline in the margins during 1995-2003 has been probably due to decline in output price as a consequence of price war.

Table 5.2: Summary of Profitability Results

The table presents empirical results of proxy ratios of commercial profitability for overall cement industry of Pakistan and by different classes of ownerships. This table presents the medium values for pre- and post-privatization periods. Before privatization period covers the period between 1986 and 1991and after privatization covers the period between 1993 and 2011. For

Indicator	Industry				Privatized				Public				Private			
	Pre-1992	Post-1992	z	prob	Before	After	z	prob	Pre-1992	Post-1992	z	prob	Pre-1992	Post-1992	z	prob
ros	0.032	0.017	1.644	0.100	0.027	0.010	1.598	0.110	0.028	-0.040	0.298	0.766	0.014	0.030	0.343	0.732
roe	0.167	0.073	3.240	0.001	0.107	0.068	1.207	0.227	0.083	0.140	0.021	0.983	0.113	0.077	1.463	0.143
roa	0.040	0.011	2.862	0.004	0.021	0.006	2.003	0.045	0.021	-0.026	0.999	0.318	0.012	0.024	1.270	0.204
roa1	0.055	0.012	2.686	0.007	0.030	0.007	2.067	0.039	0.028	-0.025	1.020	0.308	0.014	0.030	0.016	0.987
roa2	0.135	0.076	5.216	0.000	0.098	0.063	3.241	0.001	0.093	0.066	1.467	0.143	0.084	0.096	4.604	0.000
opm	0.167	0.102	2.907	0.004	0.127	0.082	2.053	0.040	0.133	0.052	0.478	0.633	0.091	0.149	3.934	0.000
opm1	0.108	0.043	5.045	0.000	0.075	0.036	2.923	0.004	0.066	0.031	0.967	0.334	0.047	0.077	4.851	0.000
opm2	0.118	0.069	3.014	0.003	0.083	0.054	1.930	0.054	0.087	0.036	0.563	0.573	0.057	0.102	4.036	0.000
opm3	0.406	0.144	6.241	0.000	0.218	0.145	2.093	0.036	0.195	0.117	1.498	0.134	0.194	0.186	5.435	0.000
roprf	1.809	1.280	1.301	0.193	1.508	1.229	0.619	0.536	1.734	0.320	0.744	0.457	1.221	1.902	1.635	0.102
gpm	0.313	0.247	3.291	0.001	0.263	0.245	2.177	0.030	0.275	0.183	2.359	0.018	0.232	0.296	4.240	0.000
npm1	0.138	0.090	2.745	0.006	0.111	0.087	1.385	0.166	0.123	0.043	0.606	0.545	0.080	0.137	4.942	0.000
npm2	23.971	33.391	-0.390	0.697	28.031	35.580	0.960	0.337	40.028	-5.512	1.307	0.191	19.308	49.368	-1.345	0.179
asto	1.180	0.671	5.306	0.000	0.772	0.639	3.179	0.002	0.683	1.219	-0.829	0.407	0.777	0.673	3.211	0.001

the tests of the significance of median change, I have used the Wilcoxon rank sum test (with its Z statistics) as my principal statistic. Prob column shows the significance level for the null hypothesis that the difference between two median values is zero. Ratios are calculated by using following formulas:

ros= net after tax income/gross sale ; roe= net after tax income/total equity ; roa= net after tax income/assets ; roa1= net profit before tax/assets ; roa2= gross profit (loss)/assets
opm= (gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses)/net sale; opm1= (gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses)/assets ; opm2=(gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses)/gross sale; opm3=(gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses)/total equity; roprf= (gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses)/consumer price index
gpm= (gross profit (loss)+depreciation)/net sale; npm1= (gross profit (loss)-neral and adminstrative expenses-selling and distribution expenses-tax)/net sale
npm2= (net after tax income+depreciation)/net sale ; tie= (gross profit and loss-neral and adminstrative expenses-selling and distribution expenses+depreciation)/financial expenses
asto= gross sale/assets

5.4. Efficiency

Production of more output from a given input is called efficiency improvement. There is evidence to suggest that governments implementing privatization policies clearly expected that privatized firms will use their financial, technological and human resources more efficiently. By removing the non-economic objectives, governments expects increased operating and financial efficiency (Megginson *et al.* [1994]). The management, in a corporate culture is answerable to shareholders for their performance regarding capital/labour efficiency gains or losses.

Overall results of my efficiency analysis show some improvement in some efficiency indicators during post reform period. Analogous to profitability ratios, I use eight ratios as a measure of efficiency improvement/decline in pre and post reforms periods. These ratios are derived from various studies conducted so far in this area. These are discussed below:

5.4.1 Labour Efficiency

It is generally argued that public enterprises suffer from innate inefficiency because they fail to exploit the available human resources efficiently. A sense of job security under public sector ownership alongside non-competitive in-cash wages and payments is perhaps considered a major cause of less than optimal labour use. After privatization, it is generally argued that new private management would exploit these resources more efficiently. Due to job insecurity and efficiency wage, workers would pay more attention to the production activities, which would ultimately improve labour productivity. I test these predictions by measuring

labour efficiency by using three ratios:

i) Net income efficiency (NIEFF) defined as net income divided by number of employees. It expresses the net surplus generated per employee during the year.

ii) Sales efficiency (nominal) defined as gross nominal sales divided by number of employees.

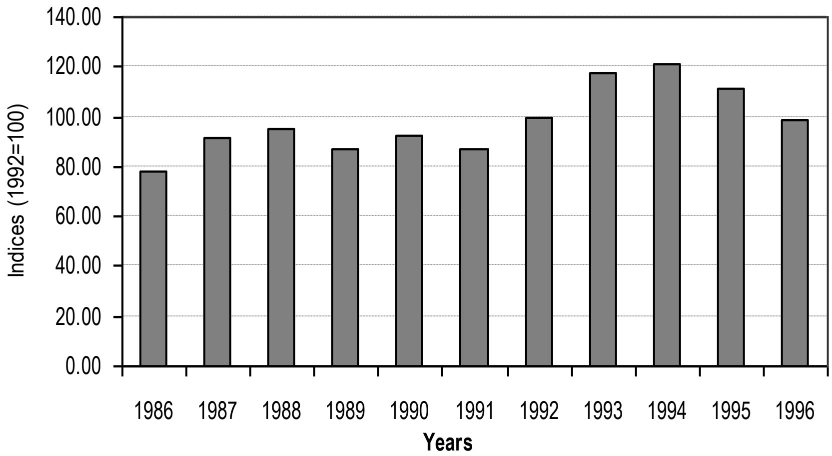
iii) Sales efficiency (real) defined as real gross sales divided by number of employees.

I estimate labour use efficiency by parametric methods in a chapter on labour use efficiency by using parametric translong cost function of labour demand later. But here in this chapter, I aim to calculate and analyze labour use efficiency with the help of simple ratios.

Table 5.3 shows the results of testing efficiency differences between pre and post reforms periods. One of such measure is the growth in profitability over time. By looking at the median values (effg) for privatized firms, I am unable to find any significant differences in post reforms periods compare to pre reform years. Similar conclusions could be drawn from other ownership forms too. Similarly, for private and privatized firms net income efficiency (nie) improved marginally during 1992-2011 as against 1986-91 but differences are not statistically significant.

Public sector firms showed an insignificant marginal decrease during post 1992 period. Immediately after reforms were introduced, nominal labour value added index also improved significantly for all firms irrespective of ownerships during 1992-96. The improvement for privatized firms was, however, higher than private and public sector firms as well as industry average during initial years of reforms. When values are expressed in real term, the increase was significant for privatized (Figure 5.6) and private firms. Public sector firms showed a decrease in their real labour value added index during this initial response period.

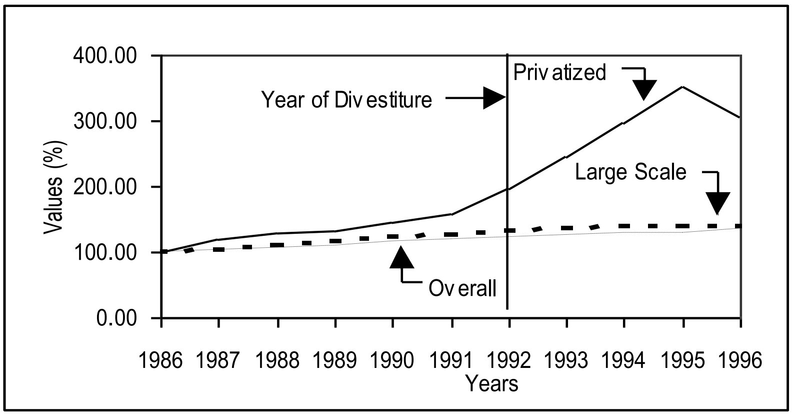
Figure 5.6: Privatized Firms: Real Labour Value Added Index (1986-96)



These gains were however, not observed in the later part of reform period and differences between pre and post reforms were statistically insignificant. Results showing an improvement in labour value added index in the initial years are an important effect of privatization. These initial gains should be analyzed by taking into account the fact that gains were made at a time when the overall economy, as well as the large-scale manufacturing sector witnessed a relatively stagnant labour productivity index in post privatization regime as seen in Figure 5.7. The trend in labour productivity index of privatized firms in the pre-divestiture period was more or less same as the overall economy and the large-scale manufacturing sector. But after 1992, the trend of labour productivity for privatized firms is significantly higher than the economy and the large-scale manufacturing sector.

Figure 5.7: Initial Response to Reforms:

Labour Productivity Indices (1986=100)

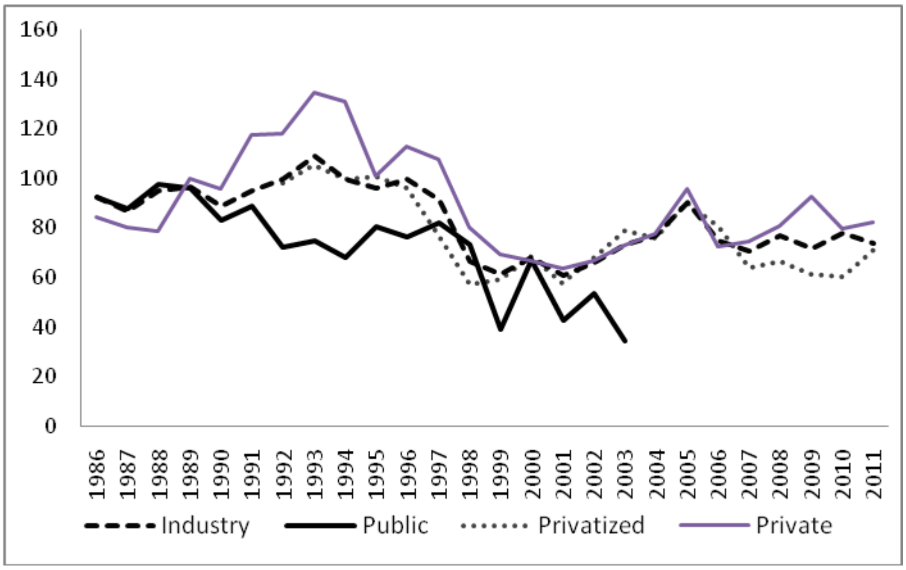


5.4.2. Capacity Utilization

Capacity utilization is a partial measure of the firm's operating performance and is defined as actual output divided by maximum out that could be produced by given technology. This measure is closely related to firms' demand structure, faced by the firm. Higher capacity utilization is generally cited as an improvement in the firm's efficiency, as it may be the product of aggressive marketing strategy, better maintenance of the plant, quality control measures, etc. In my case, capacity utilization increased significantly for both private and privatized firms during initial years of privatization (see Figure 5.8 & Table 5.3).

On the average, capacity utilization increased by 4% (from 98% to 102%) for privatized firms during 1993-96. This increase is statistically significant. While, on the other hand, private firms achieved more than 39% increase in capacity utilization but there were large fluctuations over time. Public sector firms faced a marginal decline in their capacity utilization over the 1986-96 periods. Firms, however, were unable to maintain this trend, and industry as a whole witnessed a substantial decrease (from 93% to 77%) in capacity utilization in overall post reform period. This is true for all firms irrespective of ownership and the decrease is statistically significant too.

Figure 5.8: Cement Industry: Capacity Utilization (1986-2011)



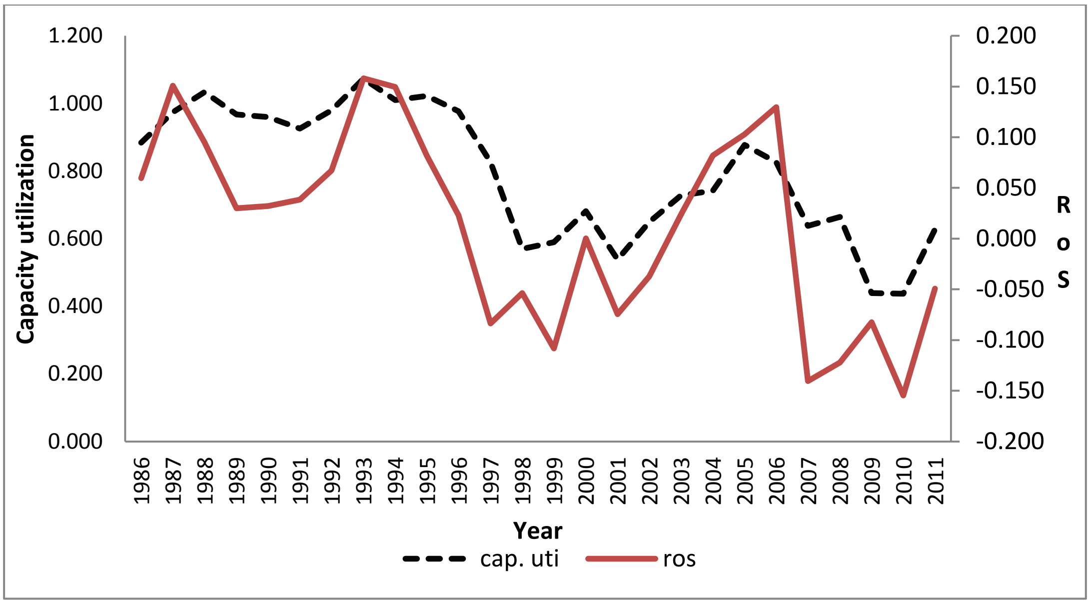
War on terror and related terrorism activities coupled with poor law and order conditions in Karachi and Sindh may be partial reason for the falling capacity utilization ratios of this group[33]. The significance of deteriorating law and order conditions that could dampen demand for cement is reflected in Pakistan's economy where GDP growth in the last few years has been low compare to 60 years historical

[33] Public sector firms comprise of 60% of firms including Thatta, Javadan and General Refectories comprised of south zone which has been under severe political unrest in the last 15 years.

rates. Further, a significant (highest) share of these capacities is concentrated in the north region of Pakistan sharing border with Afghanistan.

Poor law and order conditions and cross border activities also contributed in unrest in this region and had affected not only demand for cement but also overall construction industry at large. The variations in the capacity utilization among the firms in the three ownerships might have generally determined the cause of variations in the profitability results of these groups. Figure 5.9 shows the capacity utilization and profitability in term of return on sales. A strong relationship between these two variables is evident by the Figure 5.9. The profitability in this sense is determined not only by production levels and cost as well as demand conditions which in turn determine capacity utilization.

Figure 5.9: Privatized Firms: Capacity Utilization and Profitability (1986-2011)



5.4.3. Interval Measure

Interval measure defined as total most liquids assets including cash and short term investment divided by financial expenditures measures the firm's strength to meet the short run financial obligations. A higher ratio indicates that the firm's management is keeping a good hedge against its short time liabilities. The results in Table 5.3 indicate that irrespective of ownerships, firms decreased their strength in term of lower interval measure ratio. But decrease is only significant for private ownership firms.

5.4.4. Average Collection Period (ACP)

Average collection period is defined as average receivables divided by average daily sales and is an activity or asset utilization ratio to assess how well the management uses its productive resources. These ratios measure the number of days that the average receivable is outstanding during the year and is closely associated with management efficiency to handle the tied up assets. The lower the ratio, the lower will be the time of collection of tied up assets. It also indicates the firm's policy toward lenient/tight policy of credit sales. Higher competition levels could make this level higher. It could then lead to higher cost of sinking funds.

The average collection period showed a significant increase for private and privatized firms indicating a more lenient policy of credit sales in the post privatization regime (see Table 5.3). This result is expected because as the competition gets tense, the amount of credit sale would increase to keep the loyal customers happy. On the other hand, the average collection period for the public firms declined but the difference between pre and post reforms period is not statistically significant.

5.4.5. Inventory Turnover (ITO)

After account receivables, the most liquid assets on the balance sheet are inventories of raw material, finished goods and work in process. Inventory turnover defined as total cost of goods sold divided by total inputs and output inventories measures the spread with which the goods flow through a company. The higher the firm's turn over, the faster the inventory moves through the company and generates sales. Thus a higher inventory turnover may indicate better management skills and liquidity. The results in Table 5.3 indicate that overall; cement industry did not significantly change its inventory policy. Privatized as well as private firms show a somewhat lower value in post 1992 period indicating overstocking and inventory build up by the management to cope with sudden fluctuations in demand.

Summary of Efficiency Results: The results of the efficiency discussion show that labour efficiency of the privatized firms improved initially after privatization partly due to labour reduction by using golden handshake programs alongside an increasing level of effort. After privatization these firms have used technological resources more efficiently and as a result capacity utilization has initially improved significantly. All types of ownership firms strengthened the hedge against short-term liabilities. Asset utilization ratio in terms of average receivables has increased which shows the lenient policy in term of credit sales by the new management of these privatized companies.

Table 5.3: Summary of Efficiency Results

The table presents empirical results of proxy ratios of efficiency for overall cement industry of Pakistan. This table presents the medium values for pre- and post-privatization period. Before privatization period covers the period between 1986 and 1991and after privatization covers the period between 1992 and 2011. Table also shows the medium values in pre- and post-privatization period. For the tests of the significance of median change, I have used the Wilcoxon rank sum test (with its Z statistics version) as my principal statistic. Prob. column shows the significance level for the null hypothesis that difference between two median values is zero.

Indicator	Industry				Privatized				Public				Private			
	Pre-1992	Post-1992	Z	prob	Before	After	z	prob	Pre-1992	Post-1992	z	prob	Pre-1992	Post-1992	z	prob
effg	-0.035	-0.263	2.350	0.019	-0.220	-0.238	0.939	0.348	-0.259	-0.072	1.035	0.301	-0.190	-0.316	1.866	0.062
nie	0.022	0.055	-0.822	0.411	0.041	0.048	1.257	0.209	0.069	-0.020	0.999	0.318	0.021	0.095	-1.147	0.251
se	0.467	2.158	-12.237	0.000	1.592	2.044	-3.908	0.000	2.061	0.567	-6.100	0.000	1.051	2.680	-6.513	0.000
aspe	0.512	4.932	-11.619	0.000	2.808	4.467	-4.476	0.000	4.090	0.796	-5.037	0.000	2.008	6.844	-6.014	0.000
caput	0.933	0.768	4.228	0.000	0.796	0.763	2.483	0.013	0.793	0.774	2.157	0.031	0.791	0.789	2.621	0.009
im	1.143	0.747	1.442	0.149	0.797	0.751	0.437	0.663	0.747	0.930	-1.307	0.191	1.152	0.532	-3.779	0.000
acp	3.932	5.098	-1.364	0.173	3.709	6.700	-2.663	0.008	5.070	3.787	1.605	0.108	4.591	5.070	1.998	0.046

Notes:
effg= (return on assets -return on assets[lag])/return on assets[lag]
nie= net after tax income/labour
se= net sale/labour
aspe= assets/labour
lever= (long term loans +short term borrowing)/assets
lever1= long term loans/total equity
caput= actual production/production capacity
im= (cash and bank balance + short term investment)/financial expenses
ito= cost of goods sold/store spare and loss tool
acp= trade receivables/(net sale/360)
depns= depreciation/net sale

5.5. Output

It is expected that by improved incentives, more flexible financing opportunities, increased competition and greater scope for entrepreneurial skills, real sale will increase after privatization (Megginson *et al.* [1994]). After an extensive study of the performance of the Egyptian state-owned-enterprises (SOEs), Handoussa et al. (1986) stated that productivity and financial performance often move in opposite directions. Boycko *et al.* (1993) argued that effective privatization will lead to a reduction in output, since the government could no longer force and bribe the managers to maintain a high level of output. I test these competing predictions by using inflation adjusted sales volume for post- and pre-privatization period (see Figure 5.10). The Wilcoxon test shows that real median sales increased marginally after privatization for privatized firms (see Table 5.4). The trend however did not remain stable with increasing and then declining pattern. However, from 2004 onward, industry as a whole witnessed significant increase in sale volume. In statistical term, however, increase in post reform is only significant for private firms.

Improvement in real sales volume of the privatized firms in 2004 onward is an important result in the sense that during this period, overall economy and large-scale manufacturing sector experienced a stagnant growth in the output.

The case for inverse relationship between productivity and profitability stated by Handoussa *et al.* (1986) has not been verified in my sample of privatized firms. Figure 5.11 shows the real sales and profitability index of the divested firms. The positive relationship between these two values is evident by the trend. This explains the variations in the profitability of all three ownership firms.

Figure 5.10: Cement Industry: Real Sales (millions Rs.) (1986-2011)

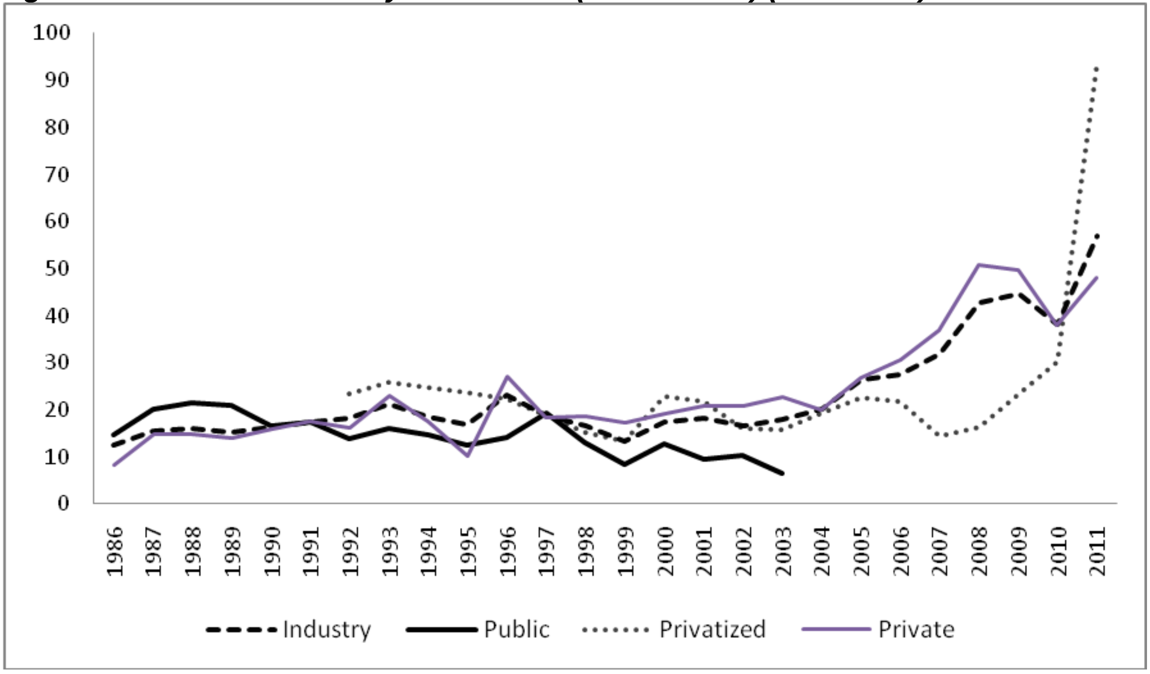


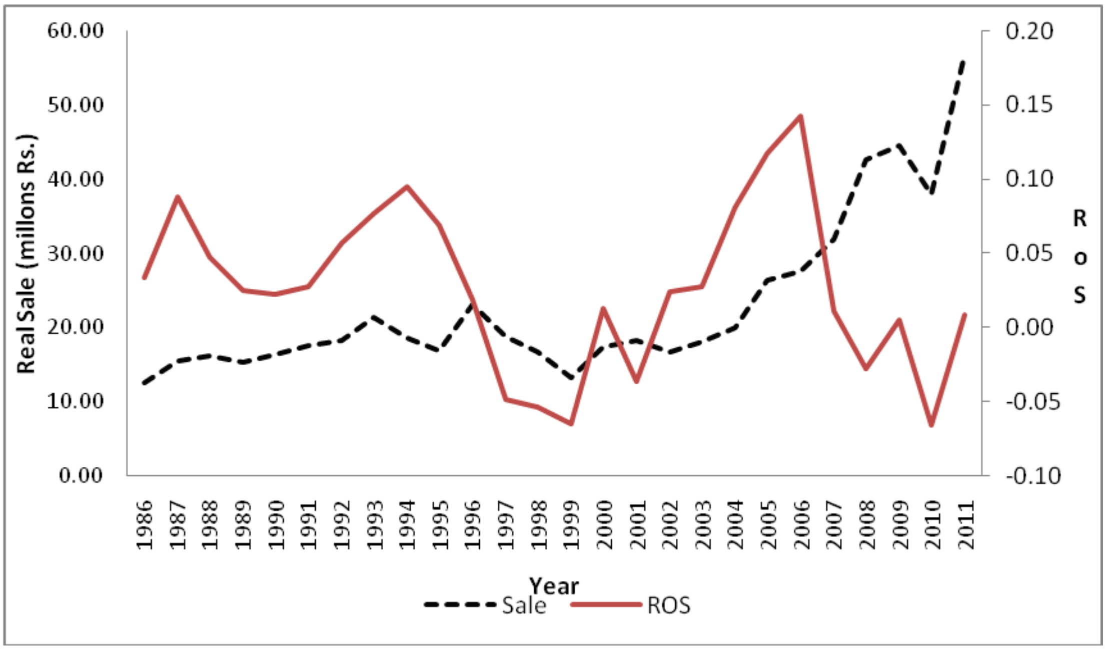
Table 5.4: Real Sales

The table presents empirical results of real sales for overall cement industry of Pakistan and by wonerships. This table presents the medium values for pre- and post-privatization period. Before privatization period covers the period between 1986 and 1991and after privatization covers the period between 1992 and 2011. Table also shows the medium values in pre- and post-privatization period. For the tests of the significance of median change, I have used the Wilcoxon rank sum test (with its Z statistics version) as my principal statistic. Prob. Column shows the significance level for the null hypothesis that difference between two median values is zero.

	Industry				Privatized			
	Pre-1992	Post-1992	z	prob	Before	After	z	prob
Sales	15.514	21.764	-4.096	0.000	20.024	21.103	-1.419	0.156
	privatized 1992				Public			
	Before	After	z	prob	Pre-1992	Post-1992	z	prob
Sales	20.024	21.103	-0.782	0.434	21.783	16.064	0.510	0.610
	Private							
	Pre-1992	Post-1992	z	prob				
Sales	18.279	22.624	-4.267	0.000				

Notes: a. Before privatization policy (1986-91).
b. After privatization policy (1992-2011).

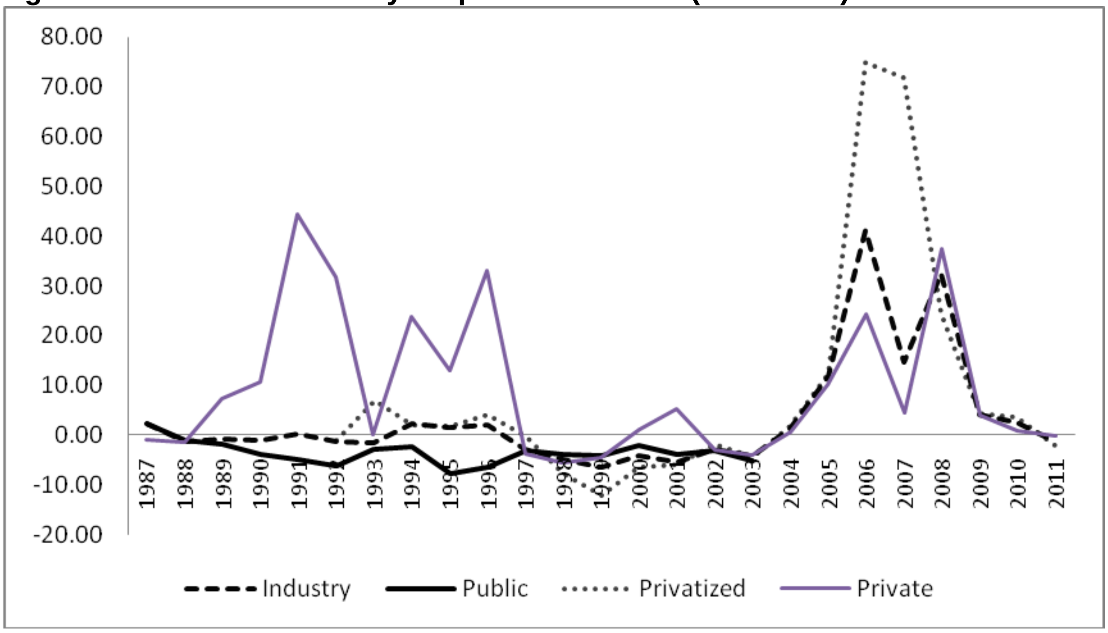
Figure 5.11: Real Sale and Profitability Relationship (1986-2011)



5.6. Capital Investment Spending

Theoretically, I would expect privatized firms to increase investment spending if the demand for their product is expected to increase in post deregulation period. Two proxy ratios are computed to measure the investment intensity; capital investment divided by sales (CAPSAL) and capital investment divided by total assets (CAPAS). Table 5.5 and Figure 5.12 show the pattern of investment spending in pre and post privatization period. By looking at the trend and statistical significance I could say that all types of firms made changes in their investment spending, but the most impressive increase is shown for privatized firms group. The increase is statistically significant for both ratios (capital expenditure to sale and capital expenditure to assets). On the average, privatized firms increased their capital investment spending from 0.1% to 2.1% of their sales after privatization. Similarly, capital expenditure to total assets figure rose from 0.1% to 1.4% in post privatization period.

Figure 5.12: Cement Industry: Capital Investment (1986-2011)



Other firms however, did not adopt the similar aggressive investment strategy. Following observations could be made to explain the significant increase in the investment by the new management:

1. Privatized companies now have more options to source funds including equity market as well as private finances.

2. These firms during their initial year of private operation (immediately after privatization) perform well in term of earning, which provided them opportunity to tap internal as well as capital market by floating the new shares.

3. As discussed earlier these firms were sold mostly to the people already with businesses in different industrial sectors. They got the expertise to exploit the rising demand by borrowing in financial markets.

4. The impressive increase was unavoidable due to years of financial stress during public ownership period, which often could lead the firms to defer even routine maintenance work.

Table 5.5: Capital Investment Spending

The table presents empirical results of proxy ratios of capital investment for overall cement industry of Pakistan and by ownerships. This table presents the medium values for pre- and post-privatization period. Before privatization period covers the period between 1986 and 1991and after privatization covers the period between 1992 and 2011. Table also shows the medium values in pre- and post-privatization period. For the tests of the significance of median change, I have used the Wilcoxon rank sum test (with its Z statistics version) as my principal statistic. Prob. Column shows the significance level for the null hypothesis that difference between two median values is zero.

	Industry				Privatized				privatized 1992			
	Pre-1992	Post-1992	z	prob	Before	After	z	prob	Before	After	z	prob
ces	-0.001	-0.001	-2.047	0.041	-0.007	0.021	-1.708	0.088	-0.005	0.015	-0.564	0.573
cea	-0.001	0.000	-1.707	0.088	-0.006	0.014	-1.893	0.058	-0.002	0.010	-0.685	0.494
	Public				Private							
	Pre-1992	Post-1992	z	prob	Pre-1992	Post-1992	z	prob				
ces	0.018	-0.028	0.987	0.324	-0.010	0.037	0.768	0.443				
cea	0.011	-0.025	1.144	0.253	-0.010	0.012	1.604	0.109				

Notes: ces= (operating fixed assets-operating fixed assets[lag])/net sale

cea= (operating fixed assets-operating fixed assets[lag])/assets

Finally, new management also opted to replace least efficiency wet process as well as adding new capacities.

5.9. Financial Leverage and Solvency

Financial leverage ratios are calculated to measure a firm’s financial risks. While devising privatization policy government though did not give importance to improve the financial soundness of the newly privatized firms, most do however; expect to see a decline in leverage ratios of privatized firms so that they could survive against changing business environment. Balance sheet as well as income statement accounts are used in this context to measure the leverage position of the privatized firms particularly and industry generally. Given the autonomy in the financial decision making regarding liquidity position of the firm (i.e. decision to keep certain amount of cash in hand and demand deposits to meet the contingency expenditures), One would expect, at least theoretically, the liquidity position of the privatized firms improve significantly. I use the ratios, which uses the most liquid current assets such as cash in hand and short-term investment in stocks divided by current liabilities generally called cash ratio.

Table 5.6 shows the summary of leverage ratios. As expected, cash ratio for privatized firms increased from 10% to 13% during the post privatization period. The increase is statistically insignificant generally though I am not able to see similar pattern for other ownership i.e. public and private. Second measure of liquidity ratio, I employed is working capital ratio. This ratio is calculated by using the difference of current assets and current liabilities and then dividing by current liabilities. Using this ratio, I come to the conclusion that similar to CR, differences in post reforms period are not significant. By using another measure such as net worth to total liabilities, the improvement is again statistically insignificant for privatized group firms similar to insignificant change in case of private and public sector firms.

The second approach to measure solvency is the use of income statement ratios. I employed time interest earned (TIE) defined as gross profit plus depreciation minus operating expenses divided by financial expenses. This ratio measures the number of times resources are available to pay back financial commitment. Table 5.6 shows that on the average, after privatization, time interest earned for privatized firms increased marginally from six times to roughly seven times. Improvement is statistically insignificant. The story for other group firms is same with minor variations.

Table 5.6: Summary of Financial Leverage Results

The table presents empirical results of proxy ratios of financial leverage for overall cement industry of Pakistan and by ownerships. This table presents the medium values for pre- and post-privatization period. Before privatization period covers the period between 1986 and 1991and after privatization covers the period between 1992 and 2011. Table also shows the medium values in pre- and post-privatization period. For the tests of the significance of median change, I have used the Wilcoxon rank sum test (with its Z statistics version) as my principal statistic. Prob. Column shows the significance level for the null hypothesis that difference between two median values is zero.

Indicator	Industry				Privatized			
	Pre-1992	Post-1992	z	prob	Before	After	z	prob
cr	0.134	0.106	1.895	0.058	0.107	0.130	-0.929	0.353
wcr	-0.098	-0.127	0.276	0.783	-0.123	-0.117	-0.627	0.531
tie	3.668	2.181	2.675	0.008	2.772	1.844	2.123	0.034
itot	81.615	53.780	2.375	0.018	71.196	38.756	3.524	0.000
nwtl	0.564	0.725	-4.972	0.000	0.703	0.705	-0.878	0.380
lever	0.379	0.307	2.031	0.042	0.316	0.310	0.981	0.326
lever1	0.522	0.398	0.649	0.516	0.466	0.323	2.199	0.028
	privatized in 1992				Public			
	Before	After	z	prob	Pre-1992	Post-1992	z	prob
cr	0.107	0.154	-1.374	0.170	0.107	0.124	-0.946	0.344
wcr	2.528	1.983	1.543	0.123	2.733	1.048	1.541	0.123
tie	-0.130	-0.049	-1.093	0.275	-0.074	-0.209	1.031	0.303
itot	67.843	37.044	3.319	0.001	53.693	90.525	-0.557	0.578
nwtl	0.709	0.703	-0.601	0.548	0.737	0.504	1.254	0.210
lever	0.320	0.300	2.176	0.030	0.289	0.496	-0.298	0.766
lever1	0.470	0.291	2.453	0.014	0.429	0.545	1.621	0.105
	Private							
	Pre-1992	Post-1992	z	prob				
cr	0.151	0.066	0.429	0.668				
wcr	-0.125	-0.110	-1.222	0.222				
tie	2.141	2.637	-1.828	0.068				
itot	64.989	50.517	-4.194	0.000				
nwtl	0.633	0.763	-2.428	0.015				
lever	0.354	0.266	1.195	0.232				
lever1	0.382	0.450	-0.670	0.503				

Notes: Following formulas are used to calculate leverage ratios:
cr= (cash and bank balance + short term investment)/current liabilities
wcr= (current assets-current liabilities)/current liabilities
tie= (gross profit and loss- general and administrative expenses-selling and distribution expenses +depreciation)/financial expenses
itot= net sale/trade receivable
nwtl= (assets-current liabilities)/total liabilities
lever= (long term loans +short term borrowing)/assets
lever1= long term loans/total equity

5.8. Dividend Payout

From a distribution of wealth point of view, pay-out ratio is very important. All the governments who adopted the privatization programs did not explicitly stated this as one of their main objective but it would be fair to say that new management is likely to distribute efficiency gains. Theoretically, it is difficult to ascertain priori about dividend pattern of the privatized firms due to the fact that new management could opt to use cash flow for maintenance or replacement of old plants and other infrastructure. The increased capital expenditure can be financed by combination of internal and external finance. A higher internal finance ratio over time could ultimately decrease the dividend. Further, the dividend pattern of the firms is determined usually by the overall corporate culture of the country. Despite of these priori difficult to determine payout outcomes, anticipation is that privatized firms will increase dividend pay-out as it could signals the firms' financial health, which is important in the initial years of the private operation. Two types of ratios are used. These are net dividend to income and net dividend to sale. The advantage of the second ratio is that it is the ratio of two current rupees insensitive to accounting anomalies.

By looking at Figures 5.13 and 4.15, I could observe that dividend payout is not regular and rather cyclical. Two sub-periods 1990-95 and 2001 to 2007 are potential candidate to see the story of dividend in the cement industry generally and privatized firm particularly. Almost zero dividends during 1996 to 2001 is consistent to profitability story. A significant decline in margins led to abandoning payouts. Except 2001-03 for private firms I am unable to note any significant shift in dividend policy in post privatization period. This is in contrast to Magginson (1994) study, which notified a significant increase in dividend to sales for the privatized firms for the sample of 61 companies from 18 countries.

An inspection of the Figure 5.13 and Figure 5.14 provides an insight of the dividend pay-out pattern of the privatized firms. Figure 5.13 show that during 1986-91 these firms paid the dividend in the range of 2 to 3% of their sales. After privatization these firms paid the dividend in the range of 3-7% of sales during 1993-95. From onward the fragile financial condition did not permit the new management for dividend declaration. But, then again dividend came back during 2001 to 2007 for industry as a whole as well as for privatized firms. Dividend to income story is same except the fact that the size of the pie significantly increased during 1993-94 due to non-operating income of the divested firms.

Figure 5.13: Cement Industry- Dividend to Sales (1986-2011)

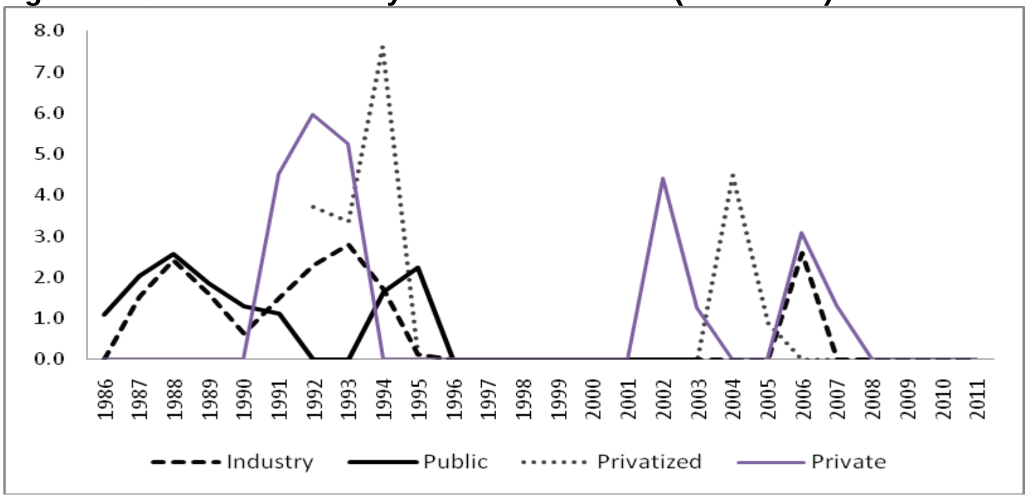
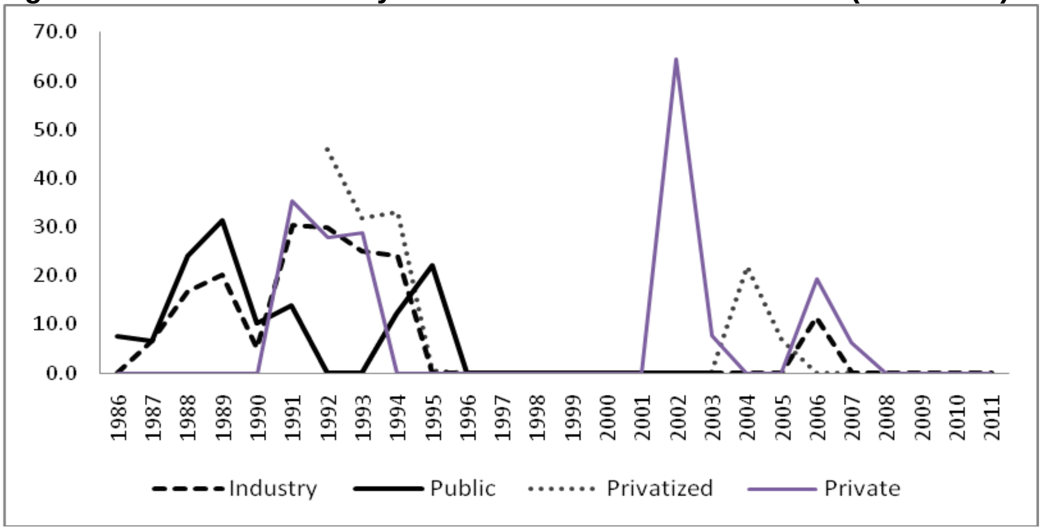
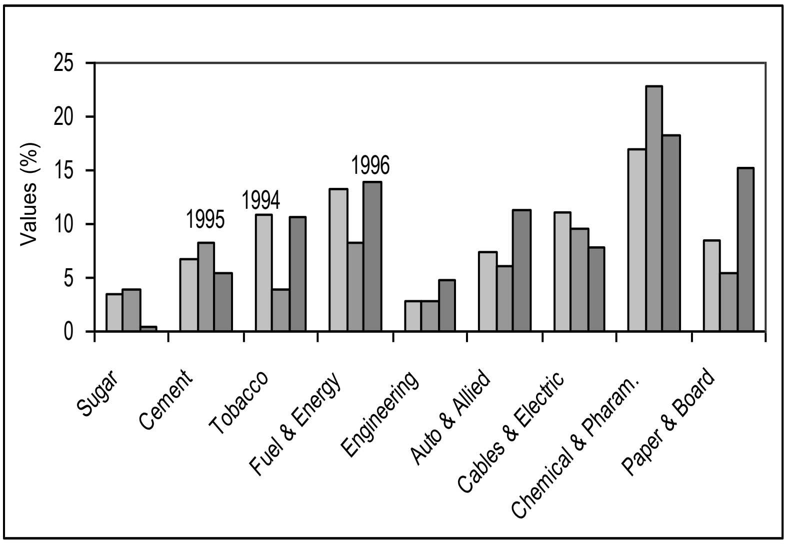


Figure 5.14 Cement Industry- Dividend to Net Profit after Tax (1986-2011)



The decline in the dividend pattern during 1995-96 to 2001 has not been limited to privatized firms alone. Figure 5.15 shows the dividend pattern of the manufacturing sector during 1994-96. During 1995-96, overall cement industry as well as sugar, tobacco, cable, and electric industry has witnessed a decline or static dividend pattern. This rather confirms the fact that dividends in Pakistan are cyclical.

Figure 5.15: Manufacturing Sector: Dividend Pay-out Pattern (1994-96)



5.9. Modelling Determinant of Performance

Up until now my focus was to address a simple question: whether change of ownership leads to better use of resources. Alongside change of ownership a list of other factors also could potentially affect performance independent of ownership. Some authors have addressed this issue by modelling profitability on political, economic, organizational, industry specific and dynamic factors. Authors such as Villalonga (2000), Garia and Anson (2012) looked at factors which could contribute toward performance of a firm in post privatization period. I followed above mentioned studies and modelled profitability, efficiency, leverage and capital expenditure on firm specific, industry specific and macroeconomic factors.

I introduced a host of initial conditions to separate the effect of ownership change from other factors. I categorized period of privatization period into four, namely yrp5, yrp10, yrp15, yrp20 for 1-5 years, 6-10 years, 11-15 years, and 16-20 years post privatization period. I include initial conditions such as log of firm assets- 1 year before privatization, firm performance -1 year before privatization, leverage -1 year before privatization and Industry profitability -1 year before privatization. Some macroeconomic conditions to separate the effect of external conditions such as inflation, employment and interest rate (discount rate) are also included. Some firm specific factors included are firm age, production process (dry=1, 0 otherwise), and regions (north=1, 0 otherwise).

Industry specific variables include industry profitability and herfindhal index (a measure of competition) to again separate the effect of ownership change from broad industry trends. I also experimented with alternative measures of profitability, but broadly, speaking results do not change. Hence in my subsequent analysis, I present the results for one profitability measure (return on assets). After conducting the test of autocorrelation, I use generalized panel least square with correlated disturbance, to account for cross panel autocorrelation. The main focus of this section is to evaluate the performance of privatized firms after change of ownership, my discussion and sample is limited to those firms who were operating before policy reforms and then they were privatized in subsequent years.

GLS results are presented (see Table 5.7) for profitability, efficiency, output (real sale) and investment (capital expenditure). I present results for profitability with two specifications. In first specification I introduce dummy variable =1 for the firms' post privatization period and 0 in public sector. In second specification, I introduce three dummy variables for post privatization period as discussed above. Overall, profitability is lower in post reforms period as compare to when firms were in public sector. But second specification results show that similar to my previous analysis by using financial ratios, immediately after privatization, firms earned higher returns on assets compare to public sector ownership period. But again, firm were unable to maintain this performance and they experienced a decline in profitability in subsequent years but decline is statistically not significant. This is an interesting result and confirms my earlier findings of non-parametric methods.

One criticism of non-parametric methods is that they ignore the control variables and thus serves as a mere descriptive statistics. As for as the effect of privatization on other dependent variables is concerned, I am unable to say that change of ownership had any effect on output or capital expenditures as the coefficients of yrp5, yrp10 and yrp15, are statistically insignificant. Net income efficiency though increased between

10-15 years post privatizations. Again these results do confirm my earlier findings of non-parametric tests on financial ratios. As for as other variables in the regression are concerned following observations could be made:

1. Firm performance is representation of industry trends as the coefficient of industry profitability is positive and statistically significant. The cyclical pattern I discuss in the above discussion to some extent is substantiated by my regression results.

2. Interest rate has a negative bearing on profitability and the effect is statistically significant. This result is not surprising as most of the firms borrowed significant amount of money in post privatization to add capacities, develop infrastructure and invest in marketing and distributions channels.

3. Firms using cost efficient technology (dry) are more profitable compare to those firms who are using relatively less efficient methods such as semi dry and wet which is more fuel consuming and less labour efficient. Age of the firm is positively correlated with profitability. Well established firms with updated technology are likely to be more experience in dealing with peaks and trough in macroeconomic environment, demand uncertainty and cost inflations.

4. As for as the effect of these variables on other performance measures such as output and net income efficiency, coefficients signs are similar and statistically significant.

5. As for as the other initial conditions variables are concerned, larger size firms at the time of privatization maintained their better performance in post privatization time period. Hence this to some extent confirms that it is more of firm characteristics and macro economic conditions rather than ownership that matter.

Table 5.7: Determinant of Profitability, Net income Efficiency, Output, and Capital Expenditures

Variable	Definition	PROFIT	PROFIT	NIE	OUTPUT	CAPEX
pvz	=1 if privatized, 0 otherwise	-0.82826				
		(2.37527)				
yrp5	=1 for the first 5 years of post privatization , 0 otherwise		5.72212**	0.38649***	0.19393	0.2542
			(1.98436)	(0.0923)	(0.13571)	(0.15653)
yrp10	=1 for the next 5 years of post privatization, 0 otherwise		-1.57125	0.14739	0.12025	0.13933
			(2.31105)	(0.10701)	(0.1594)	(0.17912)
yrp15	=1 for the next 5 years of post privatization, 0 otherwise		-1.65474	0.56933***	-0.15752	0.19649
			(2.58166)	(0.11968)	(0.17774)	(0.20038)
fsize	Initial condition: Log of firm assets- 1 year before privatization	5.50324	5.26137	0.72924**	1.88138***	1.00588**
		(5.29929)	(4.88013)	(0.23393)	(0.33988)	(0.36652)
aspe0	Initial condition: performance -1 year before privatization	-0.62092**	-0.61102**	0.00182	-0.10574***	-0.03654*
		(0.20754)	(0.19586)	(0.00919)	(0.01344)	(0.01541)
lever0	Initial condition: Leverage -1 year before privatization	-4.67460***	-4.44775***	-0.18150***	-0.38014***	-0.01732
		(0.91471)	(0.85723)	(0.04133)	(0.05925)	(0.06498)
perf0	Initial condition: Industry profitability -1 year before privatization	-0.56532*	-0.52776*	0.02440**	-0.05237**	0.05212**
		(0.25575)	(0.23761)	(0.01128)	(0.01634)	(0.01834)
t	Time trend	-1.62761**	-2.04404***	-0.00024	-0.13249***	-0.02312
		(0.57286)	(0.57765)	(0.02664)	(0.03799)	(0.04731)
indroa3	Industry profitability	0.96287***	0.87837***	0.02104***	0.02008**	-0.00246
		(0.10699)	(0.11437)	(0.00523)	(0.00741)	(0.00957)
hhi1	Competition: Herfindhal index	0.38657	0.04043	-0.00378	-0.03231	0.03805
		(0.42808)	(0.4418)	(0.02015)	(0.02861)	(0.03725)
inf	Macroeconomic environment: Inflation	-0.04243*	-0.05956**	-0.00204**	-0.00045	0.00174
		(0.01906)	(0.01986)	(0.0009)	(0.00129)	(0.00168)
employ1	Macroeconomic environment: Employment	32.28301	44.80230*	-0.31601	3.99658**	2.16042
		(19.85546)	(20.04047)	(0.92223)	(1.31899)	(1.63676)
discr	Macroeconomic environment: Interest rate	-0.38862	-0.58394**	-0.03090**	-0.0102	0.00487
		(0.20981)	(0.2174)	(0.01016)	(0.01463)	(0.0172)
dry	Production process dry=1, 0 otherwise	18.43833***	17.66870***	-0.00461	1.46506***	-0.69356*
		(4.05424)	(3.60244)	(0.16644)	(0.2474)	(0.27572)
region	Region north=1, 0 otherwise	5.03866	5.75177*	0.47695**	0.51176*	0.64671**
		(3.29872)	(3.10593)	(0.15102)	(0.21599)	(0.21833)
age	Firm age	16.07114***	15.97417***	-0.09705	1.52541***	-0.09494
		(3.43543)	(3.08877)	(0.14125)	(0.21238)	(0.23908)
_cons	Constant	-3.85E+02	-5.06e+02*	1.28013	-47.64467***	-25.5618
		(201.3698)	(202.9315)	(9.3339)	(13.36451)	(16.5745)
N		231	231	231	231	231

Notes: Figure in parenthesis are standard errors

5.10. Conclusion

Similar to trend analysis and non-parametric techniques, I reach to the same conclusion that reforms had initially positive effect on the firm's performance but then due to some tight macroeconomics and international environment, firms could not maintain the profitability and efficiency level in subsequent years. Evaluation of firms' performance based on purely strict financial criteria could be misleading if my objective is to evaluate the effect of policy reforms more thoroughly rather than just corporate profitability and efficiency. I aim to address this in my next chapter when I discuss the cost and benefits of privatization policy in a broader way. Hence, in a way, I move from accounting framework to social cost benefit analysis of privatization and deregulation policy.

CHAPTER 6

Social Costs Benefits Analysis

This chapter deals with social cost-benefits analysis of the privatization policy. The discussion moves from pure private or corporate profit and profitability (previous chapter) to public profit or social profit/total return to capital and profitability. A link is established between private and social profitability and an effort is made to reconcile the difference in private and social profitability. Thus by converting private profit to social profit, the study is able to make a like for like comparison. This type of assessment was carried out in the initial years of post privatization (early and mid 1990s) in the studies sponsored by the donor agencies such the World Bank.

6.1. Economic Performance Evaluation

In the financial analysis chapter, while discussing the financial performance, I mainly concentrated on the net return to shareholders or bottom line of income statement, namely private accounting profit. It surely provides the base for the performance evaluation. But due to accounting anomalies and ignoring of true cost and benefit to society, this measure is considered inappropriate for performance evaluation from an overall society point of view. In this chapter, the analysis start from private profit and then move to public profit; the modified version of private profit that shows the return to all of society's resources.

To represent the profit relevant to society, one could measure the public profits or quasi rent or rents to fixed capital which is a modified version of private accounting profit by treating some items, which are considered as costs in income statement but benefits in public profits[34]. Public profit is defined as followed:

Public profits = value of output - value of intermediate inputs - employees compensation -factor rental - opportunity cost of working capital.

In notation, it is defined as:

$$PPR = GS - VII - ESAW - FR - CW_C \qquad (1)$$

[34] This section has been drawn from the studies by Jones (1981), Sheikh (1985) and Galal *et al.* (1994). For comprehensive detail of economic performance evaluation methodology see these above-mentioned studies.

Where,

PPR = Public profits;

GS = Gross sales;

VII = Value of intermediate inputs (fuel, power and raw material);

ESAW = Employees salaries and wages;

FR = Factor rental; and

CWC = Opportunity cost of working capital[35].

6.2. Real Public Profitability and Productivity

To measure the productivity and profitability, I employed total factor productivity (TFP) and public profitability criteria. TFP is the ratio of benefits generated by the enterprise to its incurred costs, including the opportunity cost of fixed capital. It is defined as:

$$\text{TFP} = \frac{\text{Total benefits generated}}{\text{Total costs incurred}},$$

It is defined in notation as:

$$TFP = \frac{GS}{VII + ESAW + FR + CW_C + CF_C} \quad (2)$$

[35] A careful examination of equation (1) shows that the public profits differ from private profit in three way: first, as against private profit, it considers the items such as interest (return to debt holders), direct and indirect taxes (return to government) benefits rather than costs. Second, by considering the true economic benefits of the enterprise operation it excludes the earnings in terms of other income and opportunity costs of working capital. Third, because I am going to measure the return to fixed capital, so public profit is measured gross of depreciation.

Where GS, VII, ESAW, FR and CWC are the same as defined earlier and CFC is the opportunity cost of fixed capital.

The second measure of performance is public profitability. The idea here is to deflate the public profits by stock of fixed capital used in operation of enterprises during the year. It measures the return on fixed capital and is defined as:

$$\text{Public Profitability} = \frac{\text{Benefits- Variable costs}}{\text{Fixed capital}}$$

in notations,

$$PROF = \frac{GS - VII - ESAW - FR - CW_C}{F_C} \qquad (3)$$

Where PROF is public profitability; FC is stock of fixed capital and other variables are same, as defined earlier.

Current versus constant prices

All of the results of the above-mentioned methodology are presented in current as well as constant prices. Using 2001 as base year, indices are used to deflate the corresponding categories in current prices to arrive at constant price of output, inputs, public profits and profitability and total factor productivity. The selected criteria have been GDP deflator.

Output: Total gross sales have been considered as firm's output. The real output has been worked out by deflating the nominal sales by GDP deflator.

Inputs: Inputs used in my case are labour, fixed and working capital, fuel and energy and a residual category comprising of raw and packing material. GDP deflator is again used to convert nominal values into real numbers.

Working Capital: Working capital is defined as the sum of stores, trade receivable, short term advances, deposits and cash. GDP deflator has been used to deflate current working capital. The cost of working capital, then, is worked out by multiplying the constant series by real interest rates.

Labour: A continuous data series on number of workers is not available for privatized and private firms in post-privatization period for few years. For this purpose, I used materials from my detailed meetings with APCMA, a World Bank study (1986), and Government of Pakistan (1991). For the firms privatized in 1992, the data is available till 1992. From the Privatization Commission of Pakistan, I gathered data on number of workers who opted for golden handshake at the time of privatization. Bengali (1998) in a study of 8 privatized industrial enterprises, including two cement units, concluded that approximately 25% of the workers who opted for the golden handshake scheme were retained as contract workers. My detailed interviews with the new management confirmed this conclusion. Hence, for few missing year number of workers for privatized firms is calculated as total number of workers at the time of privatization minus number of workers who opted for golden handshake + 25% of reinstated workers. For private firms, I have three data points 1986, 1991 & 1996. Calculation of the remaining years is as: 1986 figure ± % annual average change during 1986-91. The same procedure is applied for 1992-96. Data is available on this variable from 1997 onward, with some gaps. These gaps were filled by missing values imputation methods wherever needed. Thus the series on number of workers calculated in this way is roughly at best a possible measure on the workers strength. To come across at real value of expenditures on workers, nominal expenditure on wages and allowances are deflated by GDP deflator.

Fixed Capital: The stock of fixed capital is measured by using the perpetual inventory method by adjusting disposal and deterioration in the stock. A detailed account of fixed capital component including machinery; land, vehicles and other miscellaneous are deflated by various assets classes related inflation indices. Cost of fixed capital is worked out by multiplying the nominal and constant price fixed capital series with the central bank discount interest rate.

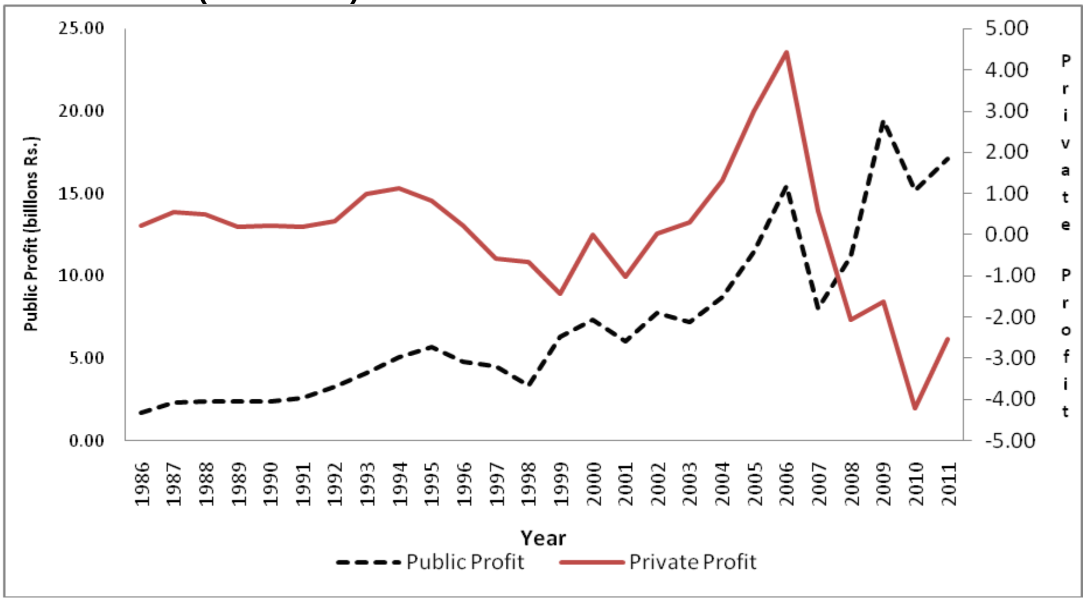
6.3. Calculation of Public and Private Profit

Figure 6.1 shows that even from a strictly commercial point of view privatized firms performance in term of private profit after tax increased significantly during 2003 to 2007 in post privatization relative to pre privatization periods. However, private profit from beginning of 2008 up until 2011 declined significantly. On the average, during pre divestiture period, private after tax profit for the privatized firms group remained Rs. 0.220 billions. It rose to Rs. 0.82 billion during 1993-96 showing a four times increase over the pre reform period.

There are five turning points to explain: one corresponding to period of relatively stable performance in public sector operation during 1986 to 1991. During this period private profit after tax remained steadily (median profit of 0.22 billion). This amount was to Rs. 0.567 billion in 1987, which, was the best year of public sector group firms operation in my sample. This increase was accompanied by a full commercial operation of D.G. Khan Cement which earned Rs. 0.175 & Rs. 0.206 billion net after tax profit in 1986 and 1987, over 30% of total earned profit of this group firms in 1986 and 41% in 1987. However this momentum could not be maintained for a variety of reasons and subsequently private profit after tax declined steadily. Second turning point is 1991, this caused a one-time decline in private after tax profit and it shrunk to a figure of Rs. 0.20 billion showing a decline of 68% over the 1987 figures. This decline corresponds to announcement of privatization of these firms.

Third point to explain is the story of post privatization period, a significant rise in private after tax profit in the initial years of private operation (1.01 billion in 1993 and 1.13 billion in 1994). During 1993 and 1994 private profit reached to a peak of more than one billion. However, this trend also proved temporarily and profit declined to Rs. 0.215 billion in 1996. However, the contribution in total private return of privatized group firms in case of D.G. Khan Cement still remained significant during this period (e.g. approximately more than 50%), and explains more than half of the variations in privatized group firms private profit after tax). During 1996 to 2003, private profit did not remain stable and reverted to overall negative (Rs. -0.28 billion). A significant turning point however was 2002 to 2006 where these sums were 4.5 billion in 2006 and average 1.34 billion during this period. But then again, from 2008 to 2011 it declined significantly with 2010 figure of negative 4 billion.

Figure 6.1 Privatized (1991-92) Firms: Public and Private Profit at Current Market Prices (Rs. Billion)



Private profit although is very useful to start with but in term of social cost benefit it tells little (only relevant for shareholders). Public profit could serve as a good proxy for this purpose and has been used widely in 1990s when researcher wanted to know the impact of privatization policies in a broader way. By looking at the above Figure 6.1 and trend of public profit, it showed a relatively sustained rise and smooth pattern with just one blip (2007-08) compare to significant variations and decline in private profit in late 1990s and 2007 onward. It looks like that the size of pie has grown substantially but its distribution got much skewed over time. Hence, total return to resources used has gone up from mere 2 billion in 1991 to 22 billion in 2009 (11 times more). This could be analyzed better by looking at the decomposition of quasi rent to resources (public profit). Table 6.1 shows this decomposition.

During 1986-91, the years of public operations, public profit remained Rs. 2.35 billions. After privatization, public profit like private profit rapidly increased in the initial years of private operation and overall it rose to Rs. 5 billion for post divestiture regime (1993-96), showing an increase of more than 100% over the pre divestiture period. During 1993-95, total incremental change in total return to capital was Rs. 2793 million and government share in this pie was Rs. 1695 million (60%). Hence government was major beneficiary of immediate impact of reform period. During this period, increase in total surplus was distributed in a sense that government received 60%, equity holders got 25%, creditors 3% and remaining 12% has gone to non-operating and depreciation costs. In sum, in the immediate period of privatization, inspection of current public profit and its distribution yields two discontinuities accompanying divestiture, one: 1993 and 1994 a period of high growth and second: a one-time decline in 1996.

This discussion leads to question that private profit after tax has declined during 1988-91, while public profit remained more or less stagnant during this period. Similarly, 1992 witnessed a maximum decline in the profit after tax profit while public profit showed a moderate recovery. During 1993-94 public profit has increased more than the increase in private after tax profit. The answer to this discussion needs some explanation regarding the growth of the total size of the pie and its distribution among different economic actors. Table 6.1 shows that over time, not only the size of the pie has fluctuated but its distribution also. During 1988-90 total surpluses and its distribution in term of direct taxes, interest and non-operating cost remained more or less stagnant but increase in indirect taxes reduced the private profit after tax. This was particularly accompanied by the fact that in 1988, government introduced the sales tax on the cement industry. This caused a regressive effect on the overall industry's financial performance. This eroded the after tax surplus during this period. 1991 although witnessed an improvement in total surplus but increase in surplus was now partly eaten up by increase in indirect as well as direct taxes and private profit after tax further reduced to all time low in my sample period.

Thus during 1988-92, total surplus and public profit although did not significantly changed and remained more or less stagnant but reduction in private after tax profit has been due to government fiscal policy in term of taxation. This is the reason that private after tax profit is considered a weak measure of performance evaluation. A significant turn to total return to shareholders however, happened during 1999-onward when at the peak it reached to Rs. 17 billions (8 time more compare to public ownership period).

In the above discussion, I have discussed the privatized firms' performance in term of private and public profit. The question still to be answered is, that whether the performance of the privatized firms has been better than the firms in other ownerships structure. I looked at total return to resources for all three types of ownership (public, private and privatized). I do not report those figures here, but overall, privatized firms' performance in term of public profit, which has been more or less same in pre divestiture period, marked a significant improvement in post divestiture regime relative to private sector firms group. Whereas public sector firms group performance, which deteriorated during 1990-92 showed a relatively better performance in post privatization period.

Table 6.1: Firms Privatized in 1992: Cumulative Return to Capital at Current Market Prices (Rs. Billions)

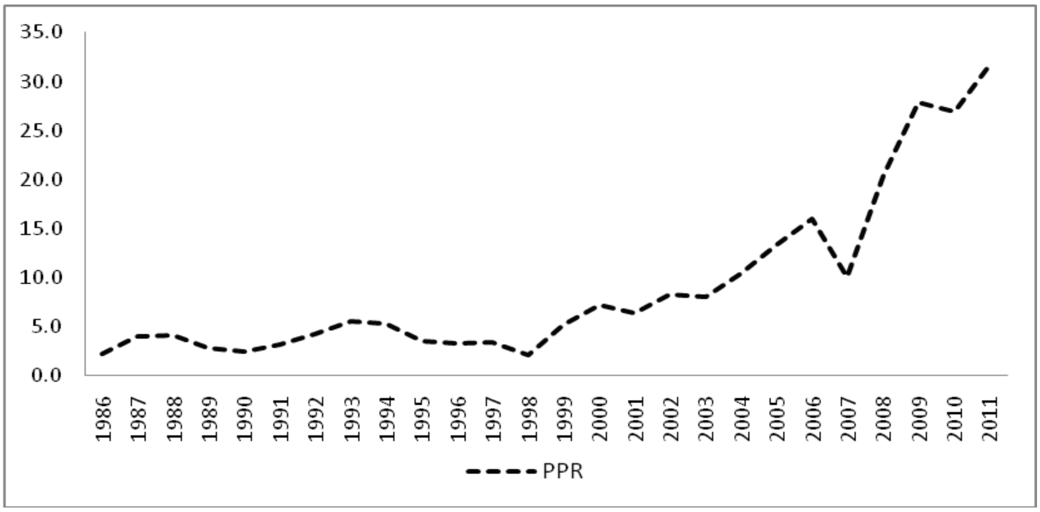
	Private profit	Gross after tax return on equity	Gross before tax return on equity	Public profit	Total return to capital
1986	0.22	0.43	1.57	1.69	1.77
1987	0.57	0.83	2.16	2.31	2.40
1988	0.49	0.77	2.22	2.35	2.49
1989	0.20	0.46	2.20	2.37	2.49
1990	0.22	0.47	2.19	2.35	2.49
1991	0.20	0.44	2.44	2.58	2.72
1992	0.34	0.58	3.14	3.31	3.49
1993	1.01	1.29	3.88	4.10	4.44
1994	1.13	1.48	4.86	5.07	5.56
1995	0.82	1.17	5.43	5.69	6.52
1996	0.22	0.59	4.49	4.78	5.75
1997	-0.57	-0.22	4.21	4.49	5.08
1998	-0.64	-0.10	2.99	3.36	4.05
1999	-1.42	0.34	5.02	6.28	6.59
2000	0.00	1.60	6.12	7.34	7.80
2001	-1.02	0.26	4.70	6.01	6.26
2002	0.02	0.96	6.40	7.76	8.05
2003	0.30	1.35	6.00	7.16	7.46
2004	1.34	2.32	8.00	8.68	9.24
2005	3.02	4.01	10.77	11.46	12.21
2006	4.44	5.47	14.43	15.47	16.61
2007	0.59	1.81	6.54	7.99	9.09
2008	-2.05	0.48	7.27	11.18	13.89
2009	-1.63	1.31	12.18	19.43	22.00
2010	-4.21	-1.22	9.28	15.17	17.19
2011	-2.53	0.75	11.41	17.10	18.97

CURRENT AND CONSTANT PROFITS: Public profit may change in response to not only changes in efficiency but also in output prices as well as in other non-efficiency-related factors. The adjustments are necessary to the particular period of public ownership where prices may be exogenously determined and are beyond the control of the management and their effect on enterprise's performance should be adjusted to understand the real changes in efficiency[36]. Hence, the next step was the calculation of public profit in constant prices.

[36] The situation in this case is not much complicated because as discussed before, government gradually reduced the control on cement prices and the presence of private sector kept the public sector to adopt competitive prices despite of monopoly power of SCCP during 1986-91.

Using 2001 as the base year, output and input prices indices were calculated and used to deflate the nominal values to arrive at the values of output, inputs and public profit in constant prices. The consequence of making adjustments for changes in prices is given in 5.2, which shows the public profit and its derivation at constant market prices. Some points are noteworthy: Real public profit remained same 1986 to 1999, and then increased impressively and peaked to 30 billion in 2011. This is impressive in the sense that labour, rental and cost of working capital steadily increased during the corresponding periods.

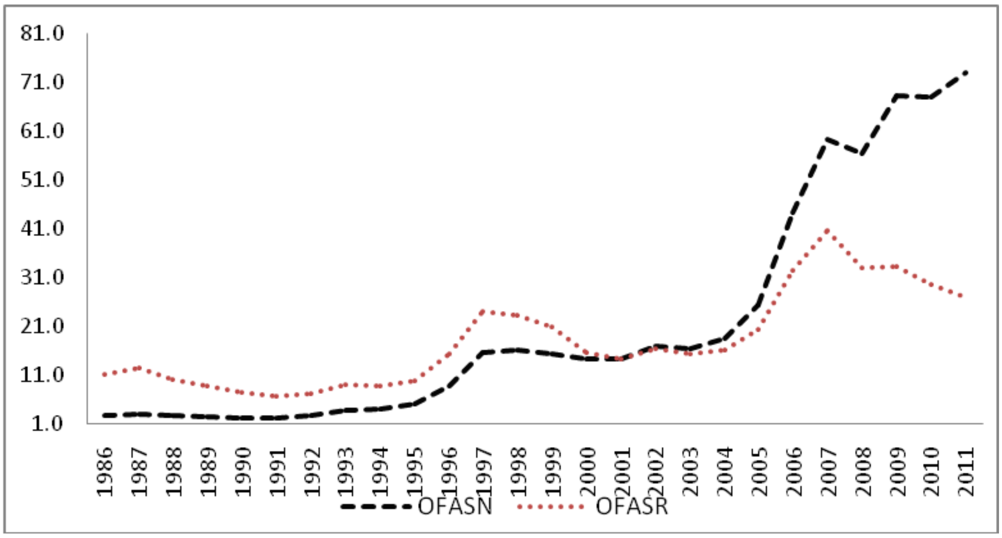
Figure 6.2: Privatized Firms: Real Public Profit (Rs. Billions) (1986-2011)



PROFITABILITY AND PRODUCTIVITY: Public profit, in constant prices, can change (increase/decrease) not only due to the change (increase/decrease) in technical efficiency, but also due to the change in endowments of fixed factors which represents technology as well . As discussed in previously, I do not expect a wide spread expansion programme during public sector regime, but new management could opt for a major restructuring in term of replacement of older plants or may opt for capacity additions. Hence public profit at nominal as well as real prices may change due to scale of operation. Thus, it becomes necessary to deflate public profit by some suitable measure of scale of production. A general practice has been the use of fixed assets or gross fixed capital formation and rated capacity of production as a measure of scale of production. I adopt the first methods for my subsequent analysis.

Gross fixed formation at nominal prices was essentially stable in pre divestiture period (see Figure 6.3), but it rose thereafter. This upward change in fixed capital formation is potentially an important change in management decisions accompanying divestiture.

Figure 6.3: Privatized Firms: Stock of Fixed Assets Formation (Rs. Billions) (1986-2011)



The results of the performance evaluation on the basis of public profitability and total factor productivity in current and constant prices are shown in Figure 6.4 and Figure 6.5.

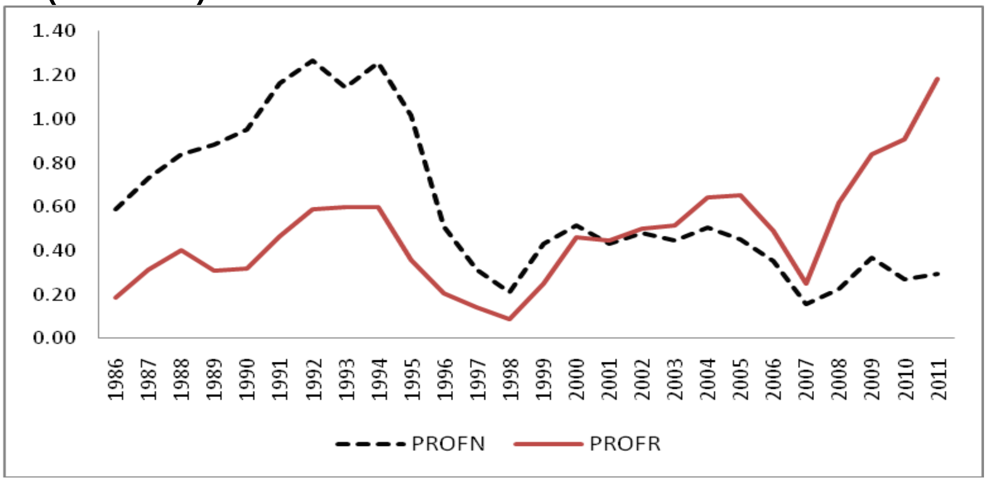
Following conclusions for privatized firms' performance can be drawn:

Like public profit at nominal as well as real prices, nominal and real public profitability was higher during 1986-88, but the increase in public profitability has been more than the increase in public profit. This was, however, discontinued in 1989-90, which showed a decrease in both nominal and real profitability. This is in contrast to any change in fixed assets during this period. During 1992-94, there has been a steady decline of both nominal and real public profitability.

The period of 1999-2006, overall showed a stable trend in both nominal and real profitability. But since 2007, real profitability has been on the rise.

Total factor productivity since 2007 improved significantly.

Figure 6.4: Privatized Firms: Public Profitability at Current and Constant Prices (1986-2011)



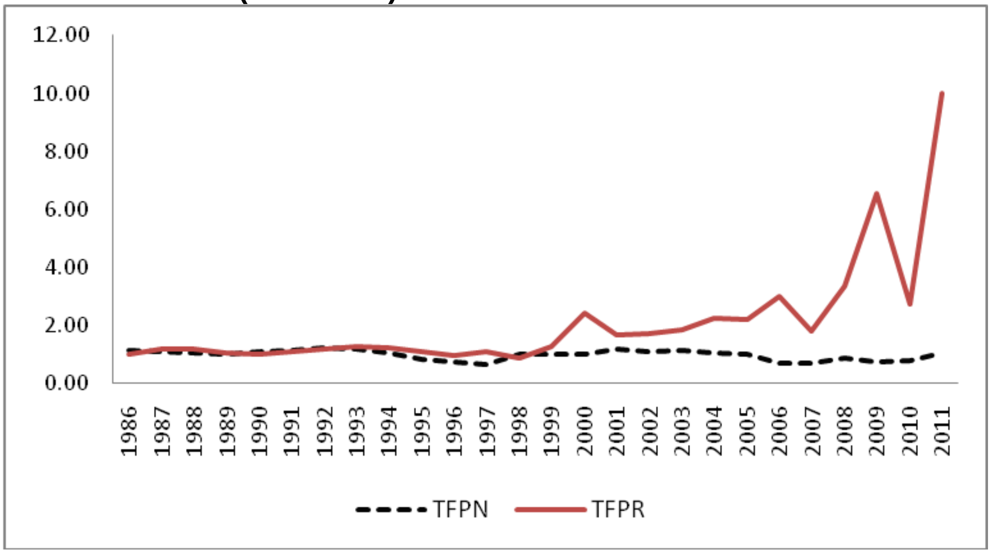
Note: PROFN= Public profitability (nominal)

PROFR= Public profitability (real)

The comparison of the privatized firms' performance in term of public profitability at nominal as well as real prices cannot be completed without comparing to other ownership firms. As these ratios are the true return to society's resources, the magnitude of the return can lead to important policy conclusion. In pre divestiture period the performance of divested and public sector firms has not been inferior in term of profitability relative to private sector firms either evaluated at nominal or real prices (figures calculated but not reported here). These results are quite accordingly to

Naqvi (1991). However, after divestiture the firms remaining in public sector has not performed better relative to private or privatized firms.

Figure 6.5: Privatized Firms: Total Factor Productivity at Current and Constant Prices (1986-2011)



Notes: TFPN= TFP(nominal)
TFPR= TFP (real)

6.4. Conclusion

A major point emerging from the above analysis is that: during 1986-91, the productivity and profitability trend remained more or less same (as the upward movement in one or two years was offset by an equal decrease in the following one or two years). The exception is 1987, which witnessed an overall increase for all types of firms. But during 1992-94, the trend showed clearly upward movement for privatized firms. But still this type of conclusion is less satisfactory without comparing it to control as well as neutral group firms in term of productive and cost efficiency and productivity under different process of production and location. All these points will be discussed in greater detail in the next chapters.

CHAPTER 7

Estimation of Efficiency and Productivity

This chapter is comprised of modelling technology of production. The chapter starts with the discussion of efficiency and then moves to estimation of technical and cost efficiency and total factor productivity. The objective of this assessment is to detect the key sources of changes in the efficiency and productivity by using parametric and non-parametric techniques. The study supplements pure parametric method of efficiency estimation with non-parametric linear programming based order-m efficiency techniques. Qualification to and explanation for the observed results are provided in this chapter.

7.1. Introduction

An intuitive notion of efficiency refers to the achievement of maximum output from a given set of resources: the greater the output relative to input, the higher the level of efficiency. Because an increased represents a kind of “manna from heaven”, it is not surprising that the study of efficiency measurement has received much attention in last thirty years, culminating in some significant analytical innovations. The purpose of the chapter is to find the evidence that either subdued financial performance in cement industry of Pakistan in post-privatization period of 1992 onward has been accompanied by improved efficiency and productivity or mere an increase in output price.

Secondary objective of the chapter is testing the relative productive and cost efficiency of public and private firms. The chapter comprises of several sections. First, I present some review of literature on industrial reforms and productive performance, second, conceptual consideration and measurement of technical and allocative (price efficiency), third, I relate theoretical discussions to firm level efficiency model specification and estimation.

7.2. Literature Review - Reforms and Efficiency

Since Farrell (1957), a long literature has developed around the problem of efficiency measurement. These includes stochastic frontier, parametric and non-parametric (linear programming) approaches. Since major liberalization and privatization waves of industrial units of Pakistan, there has not been any specific study to address the issue of productive efficiency measurement and comparison of pre and post-privatization performance for cement industry specifically. There is a wide spread disagreement on the relative efficiency of private and public sector firms. Mainly the point of controversy is related to technical or productive efficiency. On the matter of allocative efficiency, most industrial economists believe that market competition ensures that resources would be used according to market signals and firm are likely to become allocative efficient.

There is vast body of literature that does not demonstrate that public enterprises in LDC's are always outperformed by private enterprises. However, there are now studies being carried out in which comparison of relative performance of privatized firms with the firms already in private or public sector has been made. Some studies are related to Chinese industrial reforms and their impact on efficiency. A worth mentioning pioneering study in this regard is that of Zinan (1996). By using Translog and Cobb-Douglas production function, the author concluded those reform variables such as performance-related wage policy and substantial managerial autonomy in output and input decision-making has significantly contributed to the improvement in productivity.

The second earlier study is that of Cackmak (1992), by using Translog Non-Stochastic Production Function, for comparing the private, public and mixed (public and private) cement firm's technical efficiency. The author concluded that there were no significant differences in technical efficiency between different types of ownership structures. Kalirajan (1997) et al. using Chinese data of iron and steel industry derived the same results as discussed in Zinan (1996) study.

7.3. Measurement of Technical Efficiency -- Stochastic Frontier

A deterministic frontier production function may be written as:

$$y_{it} = f(x_{it}) \tag{1}$$

Where y_{it} represents the production level of the i^{th} firm at the t^{th} time period and x_{it} is a vector of core inputs used in production. The variable y_{it} is the best possible maximum output that can be produced given the known technology and techniques available. The maximum output may vary for the same firm in different time periods.

As the firm gets maximum information about the true and best relationship of its inputs and output it moves to the best level input-output of the panel. Therefore a stochastic production function can be written as:

$$y_{it} = f(x_{it}) \exp(v_{it}) \tag{2}$$

Where v_{it} is the statistical white noise with $N(0\,,\sigma^2 v)$ and is associated with factors not under the control of the firm such as weather, sudden blast of machinery and luck etc, which cause its production to vary across its mean level. However, in practice, many firms due to institutional and non-price related factors such as poor quality of labour and lack of incentives may not operate at maximum best practice output level and may be at any point inside of frontier. Best practice is also conditional on the knowledge of the management about the true technical relation of input-output. Thus it becomes imperative to examine whether the firms are able to apply successfully the technical aspects of production. As the improvement in efforts has the direct bearing on improving technical efficiency of the firm, then the realized production function can be model as follows:

$$y_{it} = f(x_{it}) \exp\,(v_{it} - u_{it}) \tag{3}$$

Where u_{it} is a non-negative random variable of ith firm specific characteristic such as age process, scale and location, which influence the firm to operate at inside the frontier.

Transfer of ownership is implicitly perceived to improve in productivity. Thus if policy succeeded to achieve this objective, the firms under new management should be on their frontier and u_{it} would have to be equal to zero or at least decline. However, if policy is partially successful then the potential gap between actual and frontier output must reduce although u_{it} would be greater than zero. Now a measure of the level of the technical efficiency of the ith enterprise can be defined as the ratio of observed to the maximum possible output when $u_{it} = 0$ as follows:

$$\exp(-u_{it})\ y_{it}|f(x_{it})\ \exp\,(v_{it}) \qquad (4)$$

It is also rational to assume that policy may effects with different intensity to different firms. In this case a firm's specific efficiency estimation becomes imperative to judge the impact of policy on firm level. Now two behavioural assumptions can be imposed:

i. There is no improvement in technical efficiency over time which means u_{it} remains constant.
ii. u_{it} decreases remains constant or increases which implies that technical efficiency may improve, remain constant or decline over time. I stick to the second assumption for the following reasons: As my mentioned hypothesis to be tested is that either policy promoted the level of efforts, alternatively u_{it} decreased over time. Due to technological characteristics, my concern is also to test the response of policy at a firm level rather than for whole industry for a specific period of time.

Following Battese and Coelli (1992), the above characteristics of the technical efficiency can be modeled as:

$$E(u_{it}) = E(\eta_{it} u_{it}) \qquad (5)$$

$$E\{exp[-\eta(t-1)]\}\, u_{it} \varepsilon\ g(i), i = 1,2,3, \dots, N \qquad (6)$$

Where u_{it} is independent random variable and h is an unknown parameters, and $g(i)$ represents the set of T_i time period among the t period for which observation for the i^{th} enterprise are available. Now u_{it} decreases, remain constant or increase depends on whether $\eta > 0$, h = 0 or $\eta < 0$ respectively.

Battese and Coelli (1992) worked out best predictor, which is a measure of efforts (technical efficiency) of the i^{th} firm at the t^{th} period. Various statistical hypotheses concerning the modelling of the frontier production function including the modelling of firm specific and time specific efficiency can be tested. These tests have been done in latter stage in my study.

Batteese and Coelli (1995) proposed a Technical Efficiency Effect model in a search to find out the factors responsible for the efficiency differences among the firms. The main advantage of this type of model specification and estimation is the simultaneous estimation of the input-output coefficients and predicted technical efficiencies. It avoids the statistical criticism of first estimating firm specific efficiency estimates and then regressing on some well-defined set of variable, which influence the efficiency.

The model specification by Battese and Coelli (1995) is as follows:

$$y_{it} = f(x_{it})\ \exp(v_{it} - u_{it}) \tag{7}$$

$$u_{it} = \delta_0 + \delta_1 t + \delta_2\ (FS_{it}) + \delta_3\ \ (PS_{it}) \tag{8}$$

Where t is time period, FS are firm's specific variables such as capacity, age, location, process etc., PS is policy specific variables and δ's are unknown parameters to be estimated. It is important to note that the above model for inefficiency can only be estimated if the inefficiency effects are stochastic and have a particular distributional specification. The hypothesis of no technical inefficiency and inefficiency effects are not stochastic should be tested before making any concrete conclusion. A specific model specification and distributional assumptions are discussed in greater details in the following sections.

A stochastic production frontier is a very useful way to judge the performance of different firms, but there is limitation to this construct. A production process can be inefficient in two ways, only one of which can be detected by estimated production frontier (that is technical efficiency). It can be technically inefficient, in the sense that it fails to produce maximum output from a given input combination due to over utilization of inputs. It can be allocatively inefficient in the sense that the marginal revenue of product of input might not be equal to the marginal cost of that input: allocative inefficiency results in utilization of inputs in the wrong proportions, given input prices. Since estimation of technical inefficiency is usually carried out on output and input only, such an exercise cannot provide evidence on the matter of allocative inefficiency and hence cannot be used to draw inferences about total or economic inefficiency.

A firm is allocative inefficient if it operates off its least cost expansion plan against the technical inefficiency where a firm operates below the feasible stochastic frontier. Incorporating these features, a derivation of system of factor demands frontier and then from them, a stochastic cost frontier can be derived.

For specification of a cost function, which assumes both technical and allocative inefficiency involved, I can follow the model specified by Schmidt *et al.* (1979).

The specification is defined as follows:

$$y_{it} = \alpha \sum_{t=1}^{n} x_{it}\, e^{\varepsilon} \tag{9}$$

Where yit is production and x_{it} is vector of inputs a's are parameters to be estimated and; $\varepsilon = v_{it} - u_{it}$ are error terms as defined earlier. If a firm is assumed to be allocatively efficient, then it will make no mistake in cost minimization factor proportion which is given by the solution to:

$$lnx_1 - lnx_i = B_i \;\; i = 2, 3, \ldots, n \tag{10}$$

Where $B_i = \ln\left(\frac{P_i\alpha_1}{P_1\alpha_i}\right)$, $P_1, P_2, and\ P_n$ are prices of inputs respectively. But if the allocative inefficiency is incorporated in the model, then, $lnx_1 - lnx_i = B_i + \varepsilon_i$. Whereas before $B_i = \ln\left(\frac{P_i\alpha_1}{P_1\alpha_i}\right)$, and ε_i represents the amount by which the i^{th} firm first order condition for cost minimization is violated. The analysis can be extended to a panel data. I further assume that there is no systematic tendency of over or under utilization of any input relative to other input.

Schmidt et al. (1979) derived the factor demand equations, and then from the factor demand equations, they derived the cost function that is:

$$\left(\frac{lnC}{P_n}\right) = K + \left(\frac{1}{r}\right) lny + \sum_{i=1}^{n} \left(\frac{\alpha_i}{r}\right) \ln\left(\frac{P_i}{P_n}\right) - \left(\frac{1}{r}\right) [(u - v) + (E - lnr)] \tag{11}$$

Where C is costs and r is return to scale parameter and term $(E - lnr)$ is the amount by which ith firm operates above its least cost expansion plan (allocative inefficiency).

I divided the cost function by factor price of an input to normalize the equation. Schmidt et al. (1979) believed that it does not matter which factor is used to normalize the equation. The model shows that allocative inefficiency and return to scale are inversely related to each other. The estimation of parameters of the above model is not quite simple involving maximum likelihood estimation of parameters of r and α and predicted efficiencies. It needs some programming involving maximum likelihood estimation of parameters of r, α and predicted efficiencies that I will discuss in greater detail later.

7.3.1. Determinants of Efficiency and Pakistani Cement Industry

i) Process

Process is the most important determinant of efficiency of cement industry. Mainly there are two types of manufacturing process used for the production of cement throughout the world, including Pakistan. These processes are: i) Wet process ii) Dry process. In Pakistan, the old cement plants, which were set up before 1975 uses the wet process for the production till late 1990s and now have gradually moved to dry process, whereas the plants being set up afterwards use the new technology i.e. dry process, which is very cost efficient. However, some of the plants use both dry and wet processes for the cement production. My sample firms use both processes. Table 7.1 shows that the group of public sector firms comprises of wet and semi-dry process except Thatta Cement, which uses dry process.

The privatized group is mixed of dry and wet process, whereas, private group firms are using mainly dry process. In Pakistan, the wet plants operate at a fuel efficiency of approximately 1,800-kcal/kg clincher while the dry process plants operate at approximately 800 kcal/kg. In comparison, in West Germany where wet process only comprises 1.4% of the total, the average fuel consumption is 740-kcal per kg cement. The total power consumption in a dry process is about 105-120 Kwh per ton of cement as against 105-110 Kwh in a wet process plant. The saving in coal consumption in dry process over wet process will more than offset the increase in power consumption. Hence, theoretically, the firms using dry process will be more efficient compared to firms using either semi-dry or wet process.

ii) Age

The plants of cement industry of Pakistan can be divided into three categories:

[1] Very old plants, now beyond their useful life and being replaced with newer plants

[2] Middle aged (15 years or so) plants

[3] Modern dry process plants

The older kilns are near the end of their life, and unless fuel costs drop substantially are not very economic. The middle-aged plants in spite of the fact that they are wet process plants are relatively comparable to dry process plants. Modern dry process plants on the other hand were mainly set up in the eighties and later and are considered the most efficient plants. The inspection of Table 1 shows that public sector firms group using mix of dry as well as wet processes were the most aged firms having a mean age of 17 years varying from highest 32 years to lowest 4 years. Privatized firms on the other hand with equal distribution of both processes were categorized as middle-aged firms varying the ages from lowest 1 year to highest 28 years with mean age of 14 years. Private firms were the youngest firms in my sample having celebrated their first or second year of commercial operation in 1986.

iii) Size

Size of the plant is an important factor of efficiency determination. The large-scale operation often has positive effect on the plant's efficiency. It is seen that the cement plants in Pakistan till late 1990s were very small, 34% of the capacity comes from plants with less than 1100 ton per day (tpd) capacity. This compares to a worldwide average plant size of 3000 tpd. The average kiln size for public, privatized and private sector plants were 751, 938 and 1080 respectively and are particularly very small (see Table 7.1). The existing kilns have an average daily capacity of 690 tpd in 1986 and 890 tpd in 1991. While, in most countries, modern plants employ kilns with capacities ranging from 2,500 tpd to 4,000 tpd. In fact the 1,100 tpd initial plant capacity is considered uneconomical by world standards.

Table 7.1: Technical Data Description (1991)

Firms Names	Process	Capacity per day in tons	Heat Consumption per ton clinker (in Kcal)	Electricity (in Kwh)	Number of kilns (numbers)	Age of kilns (years)	Number of workers (numbers)
Public Sector Firms							
Associated Cement	Wet+Dry	638	1757	135	5	32	1793
Javadan Cement	Semi Dry+Dry	667	1000	120	3	16	1026
Mustahkam Cement	Wet+Dry	700	1320	115	3	16	1137
Thatta Cement	Dry	1000	955	113	1	4	673
Mean		751	1258	121	3	17	1157
Privatized Firms							
Dandot Cement	Dry	1000	880	115	1	4	743
D.G. Khan Cement	Dry	2000	857	108	1	1	504
Gharibwal Cement	Wet	600	1560	106	3	25	844
Kohat Cement	Dry	1000	950	138	1	4	754
Mapple Leaf Cement	Wet	425	1650	90	2	28	551
Zealpak Cement	Wet	600	1680	97	6	24	1675
Mean		938	1263	109	2	14	845
Private Firms							
Dadabhoy Cement	Dry	1000	980	126	1	1	506
Cherat Cement	Dry	1100	845	108	1	1	363
Pakland Cement	Dry	1140	1050	107	1	2	250
Mean		1080	958	114	1	1	373
Industry Mean		884	1188	118	2	11	832

Source: Compiled from:
1. Cement directory (1991), NDFC, Government of Pakistan.
2. Annual Reports of Expert Advisory Cell, MOP, GOP (Various issues).

The small kiln sizes prevent the industry from attaining economies of scale in the areas of labour productivity and unit capital cost. The new public sector plants set up during 1980-85 had a design capacity of 1,000-1,100 tpd, which was also the initial capacity of the private sector plants. However, the private sector plants were designed for an expansion if needed, which could add 70% to 100% to the initial capacity. The comparison shows that the initial unit capital cost is nearly 10% lower for private sector plants, and that this difference will have to be increased significantly when the private sector plant capacities increased to full capacity.

These facts lead to the conclusion that even though initially public sector units with comparable capacity may be more efficient but the gap may be narrowed down as the private sector capacity is extended. A World Bank (1985) study estimated that manufacturing cost in Pakistan varies considerably accordingly to process. Variable costs in 1986 for dry process operation were approximately Rs.156/tonne lower and labour costs by dry process was approximately Rs.90/tonne lower comparing to wet process plants and that difference was more due to larger size production units and more modern plants design than to process difference.

iv) Scale

In the cement industry, there exists a definite advantage of operating at large scale, particularly in the production process. It is estimated that size and utilization of capacity could explain about 60 per cent of the difference in the cost of production among the existing units. For 10 percent difference in utilization of capacity, cost of production differs by about 3.5 percent. The advantage of the established firms is that they would have already reached optimal scales, while the new entrant will have to gradually reach this level. Unless the management entrepreneur opts for large size plants and higher capacity utilization, economies of scale cannot be enjoyed. So, there exists a definite direct causation. Table 7.2 sets the scene in term of initial conditions prevailing in the industry. Public sector firms were less labour productive and private firms were less capital productive (due to significant investment in capital in initial years.

Table 7.2: Technical Efficiency Indicators in the Initial Periods

Years	Real Value of Output/Fixed Capital(Rs.)			Real Value of Output/Labour (Rs.)			Real Value of Output/Working Capital (Rs.)		
	Public	Privatized	Private	Public	Privatized	Private	Public	Privatized	Private
1986-91	3.01	3.12	1.04	11.2	20.21	23.67	3.59	4.27	3.3
1986-92	3.01	3.12	1.04	11.2	20.21	23.67	3.59	4.27	3.3
1988-91	3.16	3.27	1.16	10.8	20.43	25.09	3.62	4.33	3.29
1993-96	3.3	3.68	1.57	8.83	22.44	38.87	3.18	4.58	3.41
1993-95	3.6	3.32	1.7	9.96	23.44	38.65	3.72	4.34	3.08
% Change1986-91 to1993-96									
	9.74	18.04	50.02	-21.15	11.03	64.16	-11.62	7.27	3.06

Source: Author's calculation from various sources discussed in data section.

7.3.2. Model Specification

For technical efficiency measurement I use the model proposed by Battese and Coelli (1992 &1993 & 1995) which is equivalent to the Kumbhakar *et al.* (1991) specification with exception that allocative efficiency is imposed, the first order profit maximization removed and penal data is permitted. The Battese and Coelli (1992 & 1993) model could be expressed as:

$$Y_{it} = X_{it}\,ß + (V_{it} - U_{it}),\ \ i = 1,2,3,.......,N,\ t = 1,\ 2,\ 3,\ ......,\ T \qquad (12)$$

Where, Y_{it} is logarithm of the value of output of the i^{th} firm in the t^{th} period; X_{it} is a k×1 vector of (transformation of the) inputs quantities of the i^{th} firm in the t^{th} period; ß is a vector of unknown parameters; the V_{it} are random variables which are assumed to be iid.N (0, $\sigma^2 v$), and independent of the U_{it} which are non-negative random variables assumed to be account for technical inefficiency in production and are assumed to independently distributed as truncations at zero of the N (m_{it}, $\sigma^2 u$) distribution.

Two specific forms of frontier production function are commonly used in applied research of production function estimation. These are Cobb-Douglas type production function and more flexible form of translog production function. These two types of production function are also used in my study. The stochastic Cobb-Douglas frontier production function for the whole cement industry may be defined as:

$$LogY_{it} = ß_0 + ß_i\ Xi + ß_t T + e_{it} \ .... \ (13)$$

Where Y_{it} represents log of real value of production (in million of rupees) of the i^{th} firm in the t^{th} period; and X_{it} represents the vector of inputs. I use labour (L), fixed capital (K); real fuel cost (F) and real expenditures on raw material (M). All these inputs are expressed in logs. The inclusion of time trend as an independent variable is due to separate the time invariant efficiency

The Cobb-Douglas Production Function is based on some strict assumption i.e. constant return to scale. A more flexible form of production function that is translog production function of equation 1 could be explained as:

$$y = \alpha_0 + \alpha_l * l + \alpha_f * f + \alpha_k * k + \alpha_m * m + \alpha_t * t + \alpha_{ll} * ll + \alpha_{ff} * ff + \alpha_{kk} * kk + \alpha_{mm} * mm + \alpha_{tt} * tt + \alpha_{lf} * lf + \alpha_{lk} * lk + \alpha_{lm} * lm + \alpha_{lt} * lt + \alpha_{fk} * fk + \alpha_{fm} * fm + \alpha_{ft} * ft + \alpha_{km} * km + \alpha_{kt} * kt + \alpha_{mt} * mt + \epsilon \tag{14}$$

Although stochastic production frontier is a useful construct, there are some serious limitations in the information it contains. As discussed previously, a production process can be inefficient in two ways: only one of which can be detected by an estimated production frontier. It can be technically inefficient in the sense that it fails to produce maximum output from given inputs. It can also be inefficient in the sense that marginal revenue product might not be equal to the marginal cost of that input, generally called allocative inefficiency. It occurs as a result of using of inputs in wrong proportion, given inputs prices.

Since estimation of production frontier is carried out with observations on output and inputs only, such exercise cannot give evidence on the matter of allocative inefficiency, and hence cannot be used to draw inferences about total or economic efficiency. The primary purpose of this section is to find evidence on total inefficiency in production process. Following Schmidt *et al.* (1979), Battese and Coelli (1992 &1993) stochastic cost function can be specified as:

$Y_{it} = X_{it}ß + (V_{it} + U_{it})$, i= 1, 2, 3,......., N, t = 1, 2, 3, ..., T ....

(15)

Where Y_{it} is the (logarithm of the) cost of production of the i^{th} firm in the t^{th} period; X_{it} is a k×1 vector of (transformation of the) input prices; ß is a vector of unknown parameters; V_{it} are random variables, which are assumed to be iid.N(0, $\sigma^2 v$), and independent of U_{it} which are non-negative and assumed to account of cost inefficiency (technical and allocative) and distributed as N (0, $\sigma^2 u$).

By following Schmidt and Lovell (1979) and Coelli (1995) and Kumbhakar, Nakamura & Heshmati (2000), I have used the following cost frontier function specification:

$$lnc = c_0 + \alpha_y * y + \alpha_{w_1} * w_1 + \alpha_{w_2} * w_2 + \alpha_{w_3} * w_3 + \alpha_t * t + \alpha_{yy} * yy + \alpha_{yw_1} * yw_1 + \alpha_{yw_2} * yw_2 + \alpha_{yw_3} * yw_3 + \alpha_{yt} * yt + \alpha_{w_{11}} * w_{11} + \alpha_{w_{22}} * w_{22} + \alpha_{w_{33}} * w_{33} + \alpha_{w_{12}} * w_{12} + \alpha_{w_{13}} * w_{13} + \alpha_{w_{23}} * w_{23} + \alpha_{w1t} * w_1 t + \alpha_{w2t} * w_2 t + \alpha_{w3t} * w_3 t + \alpha_{tt} * tt + \epsilon$$

(16)

Where lnc is cost of production, w_1, w_2, w_3 are prices of labour, fuel and capital, and y is output. Cost of raw material (limestone) is used as to normalize other input prices and to impose homogeneity assumption. Use of four factors of inputs in this case is due to following reasons:

1. Labour and fixed assets (capital) are two very important factor of production used almost all studies conducted on efficiency and productivity estimation. In

this study, labour variable is actual number of workers. It includes all workers including production and non production. Fixed capital is a proxy of capital stock. Use of this proxy is common in empirical literature and I use this measure in my study as well.

2. Inclusion of fuel and raw material (called intermediate inputs) is extremely important given the fact that fuel cost is almost 60% of the total cost. Excluding these costs would have compromise the total cost estimation. I am not able to get physical quantities of these inputs, hence the use of expenditures on these inputs.

7.3.3. Efficiency Prediction

The measure of technical efficiency of a specific firm can be calculated as the ratio of its mean production value given its realized firm effect, to the corresponding mean production value if the firm effect was zero. Thus the technical efficiency of the i^{th} firm denoted by EFF_{it} is defined by:

$$EFF_{it} = E\left\{({y^*}_{it} \middle| u_{it}, x_{it}) \mid E(y^*_{it} \mid u_{it} = 0, x_{it})\right\} \tag{17}$$

where, y* is value of production or cost of production of i^{th} firm in the t^{th} period . This measure necessarily has values between zero and one for production function and from one to infinity for cost function. If a firm's technical efficiency is 0.85, then it implies that the firm realizes, on average, 85% of the production possible for a fully efficient firm having comparable input values. In case of cost function, if the efficiency measure value is one, it means that cost of technical or both technical and allocative inefficiency is zero. However, the interpretation of the efficiency measure in cost function is strictly based on the assumption about u_{it}. Since, parametric cost and productions are subject to serious debate, I also estimated production efficiencies by using Data Envelopment Analysis (DEA) techniques and compared the efficiencies across these two methods.

I also estimated production function estimates to calculate total factor productivity (TF) in the cement industry in pre and post reform period. TFP measures in my study, is composed of scale efficiency and technical change. Hence increase in TFP may be due to these two contributors if efficiency has not risen in post reform period. I used a series of estimators proposed by different authors but present here very popular time trend estimator where time trend enters as an explanatory variable alongside its interactive and square terms in translog production function.

7.4. Data and Empirical Results

For estimation of technical and cost efficiency, most of the data has been collected from the following sources:

[1] Annual Report, Expert Advisory Cell, Government of Pakistan (GOP), Islamabad (various issues).

[2] Annual audited accounts of the respective companies (various issues).

[3] Annual un-audited accounts of the public sector companies (various issues).

[4] Annual report of the State Bank of Pakistan (various issues).

[5] Economic Survey, Ministry of Finance, GOP (various issues).

[6] Census of Manufacturing Industries (CMI) [various issues).

[7] Cement Directory (1991), National Development Finance Corporation, Government of Pakistan.

[8] Fifty years of Pakistan Statistics.

Following is the snapshot of the data used in my estimation of production parameters to calculate efficiency score.

Table 7.3: Descriptive Statistics of Input Output Data

Variable	Obs	Mean	Std.	Dev.	Min
y	407	7.567833	0.965161	2.808573	10.08742
l	407	6.424894	0.56199	4.70048	7.843849
f	407	6.316591	0.882131	2.135786	8.448721
k	407	7.237368	1.200868	2.665772	9.625122
m	407	5.19923	0.797437	0.914115	7.040757
t	407	13.9828	7.373378	1	26

In my presentation of estimates of the parameters of Cobb-Douglas and Translog Production Function, I considered three models; one for Cobb-Douglas and two for translog production function (Table 7.4). I carried out the adequacy of models before finally choosing the final model. Based on LLR test, my preferred model is the translog time varying production function model. The hypothesis that all translog variables are equal to zero is rejected conveniently by LLR test. Next step involved the choice between translog time invariant model which assume that persistence of inefficiencies are time invariant across firms is not justified based on the fact that privatization policy was adopted to address these persistent inefficiencies and I would expect that as a result of change of ownership, firms would have changed their input/output mix and would have become more efficient over time. Second one could test the validity of this claim by testing the statistical significance of parameters which are estimated alongside translog variables parameters. Three of these extra parameters estimated are mu, eta and gamma.

The maximum likelihood estimates for the parameter mu (μ) is associated with the distribution of in-efficiency effects during the last period of panel and is indicative of the possibility of somewhat less in-efficiency that would be indicated by half normal distribution. The maximum likelihood estimate eta (η) shows the time-varying inefficiency effects. The most significant and important parameter is gamma (γ) which measures the variances in in-efficiencies effects across the firms.

The maximum likelihood estimates of the Cobb-Douglas and translog production function for overall industry represented by different ownerships are presented in Table 7.3. The statistical significance and negative sign of eta in my preferred model indicates that for the firms used in my sample, degree of inefficiency has increased over time. It is based on the last period base level of inefficiency and other periods are compared against this last period base inefficiency. The maximum likelihood estimates of γ, which shows the variation in efficiency across the firms is very high, showing the greater variations in efficiency among different firms. The significance of

γ parameter suggests that traditional response function with no inefficiency is not adequate representation of the data. Zinan (1996) pointed out that results derived from the efficiency parameters and predicted efficiencies of this type of production function are highly sensitive to the selection of the model and related parameters. The value of eta is significant and is indication of time varying effect to be important. mu (μ) is almost insignificant.

Elasticity estimates derived from translong production could reveal the extent of role played by each input in the production of output. By calculating these estimates of the elasticities at means input, I get the impression that fuels cost plays an extremely important role in the variations of production and sale of cement. My interaction with Cement Manufacture Association does confirm this and rising fuel cost was highlighted one of the major impediment to industry revenues, profits and competitiveness. Industry has seen a lot of change in term of fuel mix in the last few years where coal is being substituted against furnace oil. It could take few years before this has any statistically significant effect on production function.

Labour	Fuel	Capital	Material
.0577831	.5975482	.0636295	.2727655

Table 7.4: Maximum Likelihood Estimates for the Parameters of the Stochastic Frontier Production Function: Dependent Variable is log of Real Value of Output

Variable	Cobb-Douglas	Translog time-Invariant	Time-varying Decay
α_l	0.08288**	0.11243	0.05004
α_f	0.57453***	0.40303***	0.46215***
α_k	0.08112***	0.12818***	0.11217***
αm	0.34811***	0.35512***	0.34457***
α_t	0.42713***	-0.07546	-0.06235
α_{ll}		-0.01193	0.02219
α_{ff}		0.048	0.04158
α_{kk}		0.02651*	0.01452*
α_{mm}		-0.09789*	-0.09056*
α_{lf}		-0.13737	-0.12228
α_{lk}		0.04727	0.03865
α_{lm}		0.21604**	0.13566
α_{fk}		-0.10994**	-0.08658**
α_{fm}		0.00552	0.02568
α_{km}		0.05196	0.04643
α_{lt}		-0.02532	0.03364
α_{ft}		0.15912*	0.09787*
α_{kt}		-0.0381	-0.03415
α_{mt}		-0.04438	-0.05505
α_{tt}		0.24116***	0.35506***
constant	-0.30549***	-0.02135	-0.15296*

Hypothesis H0: (_b[ll]=0) (_b[ff]=0) (_b[kk]=0) (_b[mm]=0) (_b[lf]=0) (_b[lk]=0) (_b[lm]=0) (_b[fk]=0) (_b[fm]=0) (_b[km]=0) (_b[lt]=0) (_b[ft]=0) (_b[kt]=0) (_b[mt]=0) (_b[tt]=0)
chi2(15) = 177.75 Prob > chi2 = 0.0000

Variable	Cobb-Douglas	Translog time-Invariant	Time-varying Decay
lnsigma2	-3.05979***	-3.33358***	-2.70764***
ilgtgamma	-0.86162	-1.20583**	0.44828
_cons			
mu	0.22774*	0.29773	0.54751*
eta	-0.01629		-0.05469**
Statistics			
N	407	407	407
ll	97.75378	134.57552	137.62465
chi^2	4.61E+03	6.01E+03	3.48E+03
df_m	5	20	20
$sigma^2$	0.0469	0.03567	0.06669
gamma	0.297	0.23044	0.61023

legend: * p<0.05; ** p<0.01; *** p<0.001

Table 7.5 reports average production efficiency levels in each year predicted by coefficients of translog production function presented in Table 7.3 by industry as well as by type of ownerships. Main results of the Table 7.4 are summarized below:

1. Average efficiency levels for the industry are 75% over the entire sample period. These figures are 76% for public sector firms, 73% for privatized and 74% for private firms. This confirms that private and privatized firms were operating almost homogenously. In a way it is difficult to differentiate these two types of and this is what I have predicted that after change of ownership, privatized firms would have behaved similar to private firms.

2. When firms are grouped by their size, large size firms are more efficient (77%) compare to small size firms (71%). The small group consists of firms using semi or wet process, which have little room for improvement due to technological drawbacks even in case of relatively stable economic conditions (1992-94). Medium size firms though are very similar to large size firms.

3. Firms operating in North region are 5% more efficient compare to firms having their factories in the South. The lower efficiency of south zone during the sample period may be due to the fact that group consists of firms located either in Karachi or nearby areas of Karachi industrial zone. The city has been badly affected by deteriorating law & order conditions during the sample period, causing the loss of working days and delays in deliveries. Firms located in north have the natural advantage of easy excess to raw material and

export access to Indian and Afghani markets. This translates into lower cost of raw material i.e. limestone, gypsum and clay etc.

4. Energy efficient dry process technology produces more efficient operations. Firms also using semi dry process are more efficient. Marginal increment of moving from wet to dry process is 5%.

5. In term of temporal patterns, industry as a whole operated at roughly 10-12% lower than pre reform period. These figures are consistent across different ownerships. This could be due to variety of reasons. One possible reason could be that the gap between least and most efficient has widened as a consequence of reforms that include change of ownership, pricing and competition. Further, decline seems to be industry wide rather than individual firms.

6. The technical efficiency estimates are derived from translong production function with strong assumptions about technology of production and priori functional form.

Table 7.5: Translog Production Function: Median Technical Efficiency Estimates

	Industry	Public	Privatized	Private	Small	Medium	Large	V. Large	North	South	Wet	Dry	Semi-dry
1986	0.846	0.846		0.862	0.835	0.858	0.845	0.879	0.875	0.842	0.840	0.871	0.862
1987	0.842	0.838		0.846	0.836	0.851	0.838	0.873	0.869	0.836	0.832	0.855	0.855
1988	0.834	0.829		0.838	0.828	0.843	0.829	0.866	0.862	0.827	0.824	0.848	0.848
1989	0.825	0.821		0.830	0.819	0.835	0.821	0.860	0.855	0.819	0.815	0.840	0.840
1990	0.816	0.812		0.821	0.810	0.827	0.812	0.852	0.847	0.809	0.805	0.832	0.832
1991	0.807	0.802		0.812	0.801	0.818	0.802	0.845	0.839	0.800	0.796	0.823	0.823
1992	0.792	0.792	0.826	0.795	0.779	0.809	0.792	0.837	0.831	0.788	0.786	0.803	0.814
1993	0.782	0.782	0.817	0.785	0.768	0.800	0.782	0.828	0.823	0.777	0.775	0.793	0.805
1994	0.771	0.771	0.808	0.774	0.757	0.790	0.771	0.820	0.814	0.766	0.764	0.783	0.795
1995	0.766	0.760	0.772	0.772	0.745	0.798	0.760	0.811	0.804	0.744	0.753	0.785	0.785
1996	0.755	0.749	0.788	0.753	0.738	0.761	0.748	0.801	0.788	0.743	0.749	0.761	0.775
1997	0.749	0.737	0.778	0.749	0.725	0.750	0.736	0.789	0.782	0.731	0.737	0.756	0.764
1998	0.752	0.724	0.781	0.744	0.712	0.752	0.761	0.778	0.772	0.718	0.724	0.759	0.752
1999	0.732	0.711	0.763	0.732	0.699	0.740	0.750	0.765	0.757	0.705	0.684	0.747	0.740
2000	0.719	0.697	0.751	0.719	0.685	0.727	0.738	0.754	0.745	0.691	0.670	0.735	0.728
2001	0.723	0.683	0.739	0.724	0.643	0.714	0.767	0.742	0.733	0.677	0.684	0.731	0.715
2002	0.693	0.669	0.718	0.701	0.656	0.701	0.712	0.730	0.719	0.665	0.640	0.710	0.702
2003	0.687	0.654	0.705	0.697	0.670	0.687	0.699	0.717	0.706	0.654	0.624	0.705	0.688
2004	0.682	0.623	0.692	0.673	0.625	0.682	0.732	0.703	0.694	0.631	0.577	0.682	0.709
2005	0.658		0.677	0.658	0.609	0.668	0.671	0.690	0.680	0.619	0.559	0.668	0.659
2006	0.643		0.635	0.643	0.592	0.653	0.656	0.675	0.665	0.602	0.541	0.653	0.644
2007	0.647		0.619	0.649	0.564	0.647	0.641	0.661	0.649	0.586	0.523	0.648	0.628
2008	0.631		0.632	0.621	0.557	0.621	0.698	0.646	0.633	0.564	0.573	0.631	0.652
2009	0.605		0.555	0.615	0.539	0.615	0.609	0.630	0.616	0.555	0.520	0.616	0.596
2010	0.599		0.568	0.599	0.521	0.599	0.648	0.614	0.601	0.537	0.501	0.599	0.579
2011	0.584		0.594	0.584	0.467	0.582	0.655	0.601	0.584	0.572	0.519	0.584	0.605
1986-91	0.830	0.825		0.834	0.824	0.839	0.825	0.863	0.858	0.823	0.819	0.844	0.844
1988-91	0.821	0.816		0.826	0.815	0.831	0.816	0.856	0.851	0.814	0.810	0.836	0.836
1993-96	0.769	0.766	0.798	0.773	0.751	0.794	0.766	0.815	0.809	0.755	0.758	0.784	0.790
1993-95	0.771	0.771	0.808	0.774	0.757	0.798	0.771	0.820	0.814	0.766	0.764	0.785	0.795
1997-2006	0.706	0.690	0.729	0.710	0.663	0.708	0.734	0.736	0.726	0.671	0.655	0.720	0.712
2007-2011	0.605		0.594	0.615	0.539	0.615	0.648	0.630	0.616	0.564	0.520	0.616	0.605
1992-2011	0.706	0.724	0.729	0.710	0.663	0.708	0.734	0.736	0.726	0.671	0.655	0.720	0.712
1986-2011	0.741	0.760	0.729	0.738	0.706	0.745	0.749	0.772	0.765	0.711	0.704	0.752	0.746

7.5. Technical Efficiency Estimation - Data Envelopment Analysis

One of the serious criticisms on the parametric approaches of efficiency and productivity estimation methods is that these techniques are based on some strict assumptions. Violations of these assumptions could lead to unreliable and less efficient estimates and then consequently conclusions purely based on these methods. Recently, a vast body of literature has started coming using some alternative methods which are not based on priori assumptions. These techniques are data driven and are based on the belief that data speaks itself. One of such technique that had been utilized successfully is Data Envelopment Analysis (DEA).

The technique of DEA involves the analysis of the rate at which firms convert a given quantity of inputs into a quantity of outputs. From this analysis, it is possible to estimate the most efficient feasible output/input combinations so as to construct an efficiency frontier. A comparison can then be made between each individual firm's input and output quantities and the efficiency frontier, so as to generate an (in) efficiency rating specific to each particular firm in the sample across time periods. The further the distance from the frontier (e.g. less output produced by each firm, given the level of input), less efficient the firm. Tracing the distance from the frontier reveals the amount by which each firm could maximize outputs subject to given inputs.

As I do not have complete information, but instead rely upon a finite data sample for the estimation of the frontier, it is likely that the estimated efficiency frontier will not be representative of the true frontier, but might be a very close approximation. Taking this into account, I construct a measure of efficiency in the same way as Wheelock and Wilson (2003). I divide the quantity of output produced by each firm by given level of input and compare this firm with a firm operating on the efficiency frontier producing maximum output by using least inputs. Intuitively, this measure will be equal to 1 if the firm is itself on the frontier. The more out produced by the firm relative to the frontier, the higher this measure will be.

The estimated frontier is subject to the same standard assumptions outlined in Wheelock and Wilson (2003), namely that the frontier itself is smooth, convex and closed, that production requires the use of some positive quantity of disposable inputs on order to produce a disposable output, that the observations used in the calculation of relative efficiency levels are representative of a probability density function (which is strictly positive at all points) with bounded support over the production set, and that the density is continuous as you move toward the interior from any point along the frontier.

I employ an expected maximum output frontier (order m) as proposed by Cazals *et al.* (2002). This methodology has certain benefits over the use of some DEA alone – for example in the reduced dependence on individual observations (lessening the impact of extreme observations on the nature of the frontier) as well as the relaxation of the assumption that the efficiency frontier is convex. More importantly, the inclusion of a noise effect is possible under this methodology. This noise effect has an expected value of zero, and allows us to differentiate between genuine and persistent inefficient operation and random shocks that are not indicative of a long term problem with each respective firm, but could otherwise cause an inefficient estimation of the efficiency frontier.

The order refers the method by which this measure of efficiency is calculated. Effectively, this refers to the k drawings of (m) firms from a pool of those producing the same level of output. The firm among this sample of (m) which produces maximum output by using lowest quantity of inputs is used in the computation of a mean from the (k) repetitions of the drawing of the (m) firms. The estimated efficiency frontier is then composed from the series of mean values generated from different input output levels. It is expected that the estimated frontier will be below the true frontier due to the finite sample used to compute the mean values for each output level.

Relative inefficiencies for each firm can then be calculated by observing the distance of the firm's input/output combination from the order-m frontier. In order to calculate this empirically, output quantity is divided by the input quantity that would be required if operating on the estimated order-m efficiency frontier. From this ratio, I can calculate the amount of more output this firm could have achieved if operating at or near to frontier. Empirically, this ratio of output to input should be <1. Any firm achieving maximum output and operating near to full potential is likely to achieve score near to 1.

I estimated output distance function for each year for the population of cement firms. Because of the fact that I estimated the efficiency by using each specific year output/input rather than pooling the data hence in effect I estimated the frontier for each year. Table 7.6 displays the output orientated efficiency estimates for cement firms using an order-m efficiency frontier. These efficiency scores are provided as median values for each individual year between 1986 and 2011. Results are also provided as averages over different time periods so that comparisons can be made between overall efficiency in both pre and post reform periods. Comparisons are therefore drawn between the before and after 1992 (representing the first round of major privatization activity). The figures displayed are an indication of the actual output given technology of production as compared to the expected maximum output amount dictated by the order-m frontier.

Table 7.6: DEA Order-m Efficiency Estimates

	Industry	Public	Privatized	Private	Small	Medium	Large	V. Large	North	South	Wet	Dry	Semi-dry
1986	0.80	0.87		0.65	0.35	0.75	0.78	0.98	0.79	0.97	0.92	0.70	0.96
1987	0.81	0.86		0.73	0.53	0.77	0.87	0.93	0.81	0.85	0.81	0.77	0.95
1988	0.83	0.86		0.68	0.51	0.75	0.86	0.99	0.83	0.80	0.83	0.75	0.95
1989	0.79	0.86		0.69	0.50	0.76	0.86	0.99	0.79	0.80	0.79	0.76	0.95
1990	0.84	0.85		0.76	0.52	0.82	0.87	0.99	0.83	0.87	0.84	0.81	0.93
1991	0.83	0.83		0.84	0.62	0.83	0.88	0.97	0.83	0.89	0.83	0.83	0.92
1992	0.82	0.80	0.83	0.74	0.49	0.78	0.83	0.99	0.80	0.88	0.83	0.78	0.94
1993	0.80	0.70	0.95	0.84	0.51	0.75	0.85	0.95	0.78	0.93	0.80	0.80	0.87
1994	0.79	0.70	0.94	0.81	0.53	0.78	0.92	0.94	0.78	0.89	0.85	0.76	0.85
1995	0.80	0.75	0.93	0.62	0.57	0.72	0.90	0.96	0.84	0.69	0.84	0.77	0.85
1996	0.85	0.63	0.80	0.93	0.56	0.93	0.77	0.91	0.90	0.65	0.91	0.90	0.71
1997	0.83	0.71	0.83	0.85	0.54	0.91	0.83	0.80	0.91	0.69	0.83	0.83	0.80
1998	0.86	0.61	0.91	0.88	0.54	0.90	0.92	0.79	0.91	0.60	0.91	0.88	0.65
1999	0.83	0.60	0.82	0.87	0.57	0.84	0.91	0.76	0.89	0.60	0.79	0.87	0.58
2000	0.81	0.57	0.93	0.81	0.62	0.79	0.98	0.89	0.89	0.65	0.84	0.81	0.71
2001	0.80	0.54	0.80	0.84	0.64	0.83	0.73	0.88	0.88	0.68	0.68	0.83	0.70
2002	0.84	0.51	0.87	0.85	0.83	0.84	0.87	0.87	0.86	0.71	0.78	0.84	0.67
2003	0.78	0.45	0.74	0.80	0.78	0.77	0.75	0.88	0.84	0.72	0.68	0.79	0.66
2004	0.78	0.46	0.87	0.77	0.66	0.75	1.00	0.87	0.87	0.72	1.00	0.77	0.87
2005	0.81		0.89	0.74	0.62	0.80	0.90	0.89	0.91	0.71	0.99	0.78	0.67
2006	0.78		0.86	0.76	0.73	0.74	0.89	0.91	0.91	0.69	0.98	0.77	0.67
2007	0.79		0.74	0.83	0.753	0.67	0.82	0.93	0.82	0.62	0.60	0.79	0.82
2008	0.72		0.72	0.74	0.78	0.67	0.81	0.94	0.80	0.69	0.66	0.72	0.94
2009	0.68		0.63	0.72	0.74	0.64	0.66	0.95	0.72	0.68	0.60	0.70	0.79
2010	0.75		0.73	0.78	0.75	0.73	0.75	0.95	0.78	0.66	0.61	0.78	0.70
2011	0.78		0.89	0.76	0.71	0.73	0.89	0.98	0.81	0.73	0.84	0.76	0.96
1986-91	0.820	0.856		0.711	0.516	0.765	0.866	0.985	0.817	0.860	0.832	0.766	0.953
1988-91	0.834	0.852		0.728	0.516	0.792	0.866	0.989	0.827	0.836	0.832	0.788	0.940
1993-96	0.800	0.697	0.932	0.826	0.544	0.766	0.876	0.945	0.811	0.785	0.846	0.784	0.852
1993-95	0.800	0.698	0.937	0.811	0.531	0.754	0.898	0.954	0.778	0.885	0.839	0.768	0.853
1997-2006	0.808	0.556	0.862	0.824	0.631	0.818	0.896	0.874	0.888	0.692	0.837	0.818	0.672
2007-2011	0.752		0.734	0.759	0.741	0.673	0.812	0.951	0.799	0.684	0.609	0.759	0.819
1992-2011	0.798	0.609	0.844	0.804	0.619	0.772	0.861	0.907	0.851	0.689	0.829	0.784	0.754

In term of a comparison between time periods, it would appear that the separation around 1992 reveals an interesting fact that immediately after privatization efficiently levels marginally improved to 86% from 82% in pre reform period for overall industry. But then subsequently, started declining and overall, I am unable to see any notable difference in pre and post reforms period for overall industry. There are some major decreases in efficiency levels for some years but overall efficiency scores are nearer to 0.8 (implying industry firms are using their resources 80% efficiently). Hence, reforms do not appear to have any significant effect, indicating a seemingly neutral effect of the 1992 deregulations/privatization upon efficiency.

Figure 7.1: Order m Technical Efficiency Estimates by Ownership

.

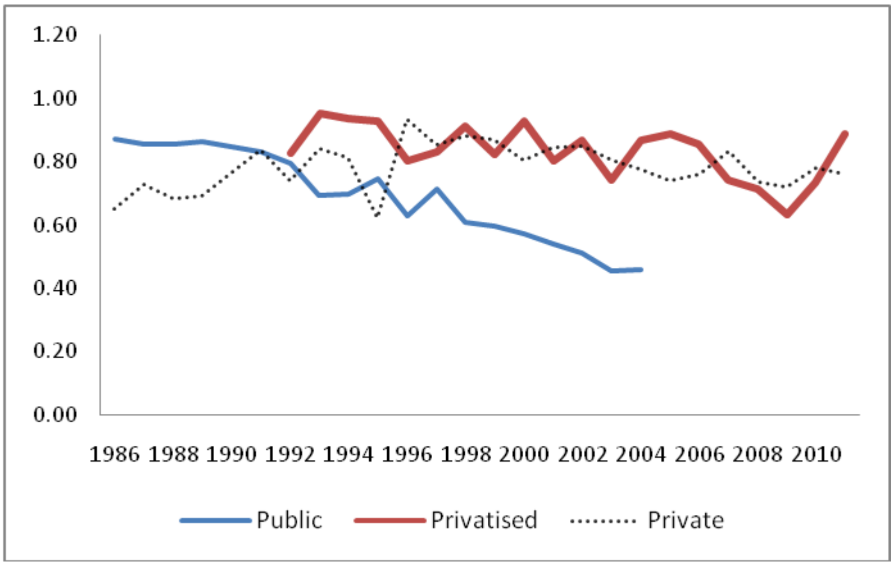


Figure 7.1 and Table 7.5 shows order-m input efficiency estimates for three type of ownerships: public, private and privatized, where order of the m is 5. The immediate trend observable here is that it is difficult to see any significant difference in

efficiencies between private and privatized firms, although, private firms did catch up in post reforms period. All those firms which were not privatized during first round of privatization, their efficiency levels were lower consistently till the time they were privatized subsequently. When firms are grouped according to different sizes, small size firms did improved their efficiency in post reform period by almost 8-10% but, for all other size firms, no significant difference is noticed with some variations across the years. There seems to be increasing levels of efficiencies as the firm size increases. Larger size firms are roughly 35-40% more efficient compare to very small size firms. This difference is 10-12% between medium and large size firms. Firms operating in North region appear to be more efficient compare to South regions. This is expected given the fact that they are nearer to export markets India and Afghanistan. Firms operating in the South region though have one clear advantage in term of their close proximity to port (Karachi and Gwadar). Technology of production (wet, dry and semi dry) does not appear to have any significant effect with the exception of few years differences. This is also expected as majority of the firms since 1992 had moved to smart dry process.

7.6. Estimating Change in Total Factor Productivity (TFP)

Overall, cement industry witnessed a 3% per annum growth rate during my sample period (Table 7.7). Public sector firms, until their eventual privatization, grew by 1.18% compare to 3.3% for privatized (highest) and 3% for private firms. In term of size of the firm, small size firms grew relatively less (2.44% compare to average 3% for medium and large size firms).

Deregulation and privatization period appear to mark a significant shift in productivity. Productivity growth during 1992-2011 is almost homogeneous across different types and ownerships. But within this deregulation period, highest growth rate was, during 2007 to 2011, when total productivity grew by almost 5.6% per annum. Immediate effect of reform was also noticeable when productivity grew by roughly 2% per annum compare to <1% growth rate in pre reform period.

All this lead to conclude, that deregulation and privatization had a desired effect on productivity. This is in contrast to technical production efficiency results which declined or remained stagnant. Productivity could have increase due to variety of sources and efficiency change is just one component. Other components include allocative efficiency, scale efficiency, technical progress (technical change) etc. One could explore these sources of productivity growth to see from where it has come. I would explain this in my next section of cost efficiency estimation and a chapter when I explore substitution of inputs by management in response to changing environment in term of competition and rising energy and raw material prices after deregulation and privatization policies were introduced in early 1990 which forced management to compete in input market to source their input and also as a result of government withdrawal of subsidies on petroleum products. Interestingly, for small size firms productivity growth was negative in pre- reforms period but then some growth in post reforms period.

Table 7.7: Total Factor Productivity by Period, Ownership and Size (%)

	Industry	Public	Privatized	Private	Small	Medium	Large	V. Large
1987	-0.07	0.00		-0.15	-1.95	-0.17	0.52	0.67
1988	0.50	0.52		0.07	-2.46	0.05	0.49	0.93
1989	0.76	1.18		0.74	1.56	0.59	0.62	1.49
1990	0.87	0.70		1.45	-0.72	0.87	0.60	1.38
1991	1.55	1.64		1.02	-0.62	1.33	1.74	1.47
1992	0.78	0.46	0.78	1.40	1.42	0.10	0.66	1.30
1993	1.80	1.53	1.81	1.70	1.65	0.99	1.98	-0.74
1994	1.75	0.78	3.03	0.82	0.92	0.66	2.34	1.94
1995	2.37	2.72	2.16	3.36	2.46	0.92	2.72	2.29
1996	2.57	2.48	2.62	2.61	-1.41	3.78	2.48	3.77
1997	2.99	1.45	3.02	2.99	3.25	2.82	3.32	0.68
1998	2.41	2.32	2.36	2.42	2.42	2.72	3.04	-0.21
1999	2.67	-0.14	2.77	2.57	8.05	2.17	1.17	2.97
2000	3.29	4.05	3.29	2.78	-0.06	3.46	3.88	2.44
2001	3.27	0.48	3.38	3.46	3.60	3.33	2.98	3.55
2002	3.52	3.52	3.82	3.21	4.31	3.21	3.48	3.68
2003	3.60	-10.32	3.50	3.93	3.62	3.60	1.27	3.86
2004	4.33		4.42	4.24	5.43	4.03	4.43	3.63
2005	4.82		4.82	4.77	4.24	5.24	4.97	4.68
2006	4.73		4.76	4.54	5.78	4.40	4.52	4.79
2007	5.24		3.16	6.89	6.12	5.89	3.16	5.43
2008	5.74		5.74	5.90		5.57	8.61	5.74
2009	6.49		6.37	6.88	6.88	5.71	7.94	6.61
2010	3.76		5.41	3.14	-0.57	4.48	4.92	3.14
2011	5.53		5.53	5.53	5.44	5.61	5.55	4.85
1987-91	**0.76**	**0.70**		**0.74**	**-0.72**	**0.59**	**0.60**	**1.38**
1993-96	**2.09**	**2.01**	**2.39**	**2.16**	**1.29**	**0.95**	**2.41**	**2.11**
1997-2006	**3.41**	**1.45**	**3.44**	**3.34**	**3.93**	**3.40**	**3.40**	**3.59**
2007-2011	**5.53**		**5.53**	**5.90**	**5.78**	**5.61**	**5.55**	**5.43**
1992-2011	**3.41**	**1.49**	**3.33**	**3.28**	**3.60**	**3.53**	**3.24**	**3.59**
Overall	**2.99**	**1.18**	**3.33**	**2.99**	**2.44**	**3.21**	**2.98**	**2.97**

7.7. Measurement of Cost Efficiency

Translog cost function with four input prices and single out is estimated by using Maximum Likelihood method. Results of these estimates are shown in Table 7.8. Similar to production function, I estimated three models. First model is simple Cobb-Douglas model with three input prices and an output. Input prices are normalized by fourth input price to impose homogeneity restriction on input prices which is a norm in empirical studies such as this one. Next two models are translog models with time invariant cost inefficiency imposed and a model with time decay inefficiency effect. Validity of the translog against Cobb-Douglas was tested using LLR test. I conclude that translog terms are needed in the cost function to reflect the nature of the data and technology of production. I also tested the presence of some other functional form (not reported here) but again results were in favour of translog cost function. Elasticities (given below) of costs with respect to inputs and output are in accordance to theory.

Labour	Fuel	Capital	Output
0.123	0.5645	0.1155	0.8715

Again similar to production function, elasticity of cost with respect to fuel is the highest. Labour and capital elasticities combine are less than half of the fuel elasticity. Value of gamma indicates some variations in the cost function across different firms. This value is though less than production function value. Overall model fit is reasonable and predicted inefficiencies based on this model is representative of underlying production process. Predicted cost efficiencies are presented in the next section.

Table 7.8: Maximum Likelihood Estimates for the Parameters of the Stochastic Costs Frontier

Variables	Cobb-Douglas	Translog time-Invariant	Time-varying Decay
αy	0.74391***	0.76257***	0.76039***
αw1	0.24175***	0.05939	0.0842
αw2	0.35256***	0.57955	0.56957
αw3	0.11829***	0.36463***	0.36516***
αt	-0.09965*	0.87740**	0.89854**
αyy		0.02458**	0.02381*
αyw1		-0.19126***	-0.18598***
αyw2		0.15824**	0.15691**
αyw3		0.08581***	0.08572***
αyt		0.10384	0.10574
αw11		0.13184*	0.13832*
αw22		0.13603	0.13234
αw33		-0.03433***	-0.03422***
αw12		-0.41377**	-0.40679**
αw13		-0.08011	-0.08521
αw23		0.24757***	0.24816***
αw1t		-0.06597	-0.09357
αw2t		0.28301	0.29151
αw3t		-0.30625***	-0.30612***
αtt		-0.71327***	-0.71506***
constant	-0.2917	0.02752	0.0033
lnsigma2	-3.11197***	-3.53282***	-3.60492***
ilgtgamma	-0.7291	-1.14331	-1.47673
mu	0.55926	0.06721	0.0698*
eta			0.01212*
Statistics			
N	407	407	407
ll	111.8926	182.6205	182.666
chi2	2.99E+03	7.57E+03	7.75E+03
df_m	5	20	20
sigma2	0.04451	0.02922	0.02719
gamma	0.32539	0.24171	0.18592

Hypothesis H0: yy= yw1= yw2= yw3= yt= w11= w22= w33= w12= w13= w23= w1t= w2t= w3t= tt=0
chi2(15) = 177.75 Prob > chi2 = 0.0000

legend: * p<0.05; ** p<0.01; *** p<0.001

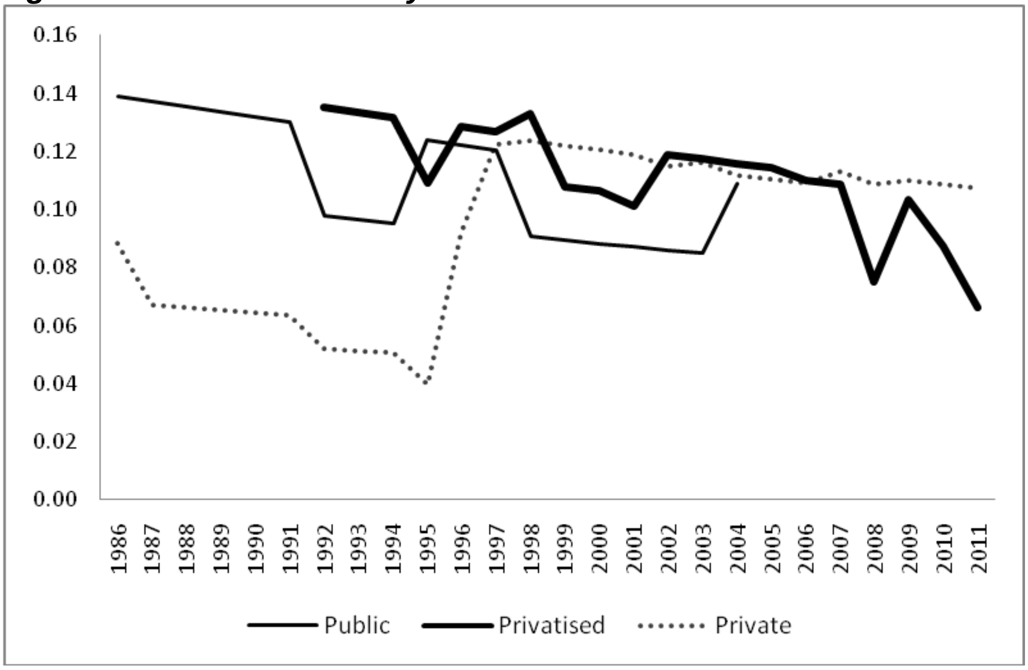
Predicted Costs Efficiencies

The results of the predicted costs efficiencies are given in Table 7.9 and summarized below:

Overall, firms appear to be responding marginally in the immediate period of reforms. But then for the industry overall, these changes are insignificant. When firms are grouped according to ownership, then initially during 1986-90, private sector firms on the average were marginally more cost efficient (most of the inefficiency may be attributed to cost of technical inefficiency if the assumption of allocative efficiency is imposed). This result may be due to newer technology and more optimal scale of operation. But as competition developed cost inefficiency subsequently has declined significantly for these ownership firms. The decline in cost inefficiency may be due to higher capacity utilization during 1993-96 and resulting economies of scale. Privatized firms on the other hand also did better subsequently and cost inefficiency declined in the post-privatization period.

The rate of increase in cost efficiency is roughly 4% for the comparable pre reform period. If I assume that in pre-privatization period these firms were both allocatively and technically inefficient, then the improvement in cost efficiency may be the result of significant decrease in allocative inefficiency and that could have translated into higher productivity. In case of public sector firms the cost efficiency has also been improved during 1993-96 over 1986-91. However, in case of technical efficiency estimates the efficiency has been declined. If the assumption of allocative inefficiency is assumed [see Toda (1976)], then this leads to conclusion that firms has become allocative efficient during 1993-96.

Figure 7.2: Cost Inefficiency Estimates



i. When firms are grouped according to scale, small scale firms are most cost efficient compared to medium and large scale firms during 1986 to 2011.

ii. When firms are grouped according to location the north region firms are similar to south region firms.

iii. When firms are grouped according to process, the dry process firms were marginally more cost efficient to their counterpart of semi-dry or wet process firms. This is also consistent to my technical efficiency estimates.

Table 7.9: Predicted Cost Efficiency Estimates

Years	Industry	Public	Privatized	Private	Small	Medium	Large	V. Large	North	South	Wet	Dry	Semi-dry
1986	1.139	1.14		1.09	1.043	1.057	1.139	1.166	1.14	1.09	1.12	1.10	1.15
1987	1.117	1.14		1.07	1.055	1.056	1.137	1.164	1.14	1.09	1.12	1.08	1.15
1988	1.116	1.14		1.07	1.054	1.056	1.135	1.162	1.14	1.09	1.12	1.08	1.14
1989	1.114	1.13		1.07	1.054	1.055	1.134	1.160	1.13	1.09	1.12	1.08	1.14
1990	1.113	1.13		1.06	1.053	1.054	1.132	1.158	1.13	1.09	1.12	1.08	1.14
1991	1.112	1.13		1.06	1.052	1.053	1.130	1.156	1.13	1.08	1.12	1.08	1.14
1992	1.092	1.10	1.14	1.05	1.041	1.053	1.129	1.154	1.13	1.08	1.11	1.06	1.14
1993	1.091	1.10	1.13	1.05	1.041	1.052	1.127	1.152	1.13	1.08	1.11	1.06	1.13
1994	1.089	1.10	1.13	1.05	1.040	1.052	1.125	1.150	1.13	1.08	1.11	1.06	1.13
1995	1.081	1.12	1.11	1.04	1.040	1.037	1.124	1.148	1.09	1.08	1.11	1.05	1.13
1996	1.123	1.12	1.13	1.09	1.049	1.094	1.122	1.146	1.12	1.13	1.15	1.09	1.13
1997	1.123	1.12	1.13	1.12	1.049	1.093	1.121	1.163	1.12	1.13	1.14	1.10	1.13
1998	1.121	1.09	1.13	1.12	1.048	1.121	1.102	1.161	1.12	1.13	1.14	1.10	1.13
1999	1.118	1.09	1.11	1.12	1.048	1.119	1.101	1.177	1.12	1.13	1.13	1.10	1.12
2000	1.117	1.09	1.11	1.12	1.047	1.118	1.099	1.175	1.12	1.12	1.12	1.10	1.12
2001	1.115	1.09	1.10	1.12	1.037	1.116	1.082	1.173	1.11	1.12	1.07	1.12	1.12
2002	1.114	1.09	1.12	1.11	1.046	1.115	1.097	1.171	1.08	1.12	1.12	1.10	1.12
2003	1.113	1.08	1.12	1.12	1.055	1.113	1.096	1.168	1.11	1.12	1.12	1.11	1.12
2004	1.114	1.11	1.12	1.11	1.045	1.115	1.079	1.166	1.05	1.12	1.17	1.10	1.12
2005	1.111		1.11	1.11	1.044	1.113	1.093	1.164	1.08	1.12	1.17	1.09	1.12
2006	1.109		1.11	1.11	1.044	1.112	1.092	1.162	1.08	1.11	1.17	1.09	1.11
2007	1.112		1.11	1.11	1.050	1.113	1.091	1.160	1.11	1.11	1.16	1.11	1.11
2008	1.106		1.07	1.11	1.043	1.109	1.069	1.158	1.05	1.11	1.06	1.11	1.12
2009	1.106		1.10	1.11	1.042	1.110	1.089	1.156	1.05	1.11	1.11	1.09	1.11
2010	1.102		1.09	1.11	1.042	1.109	1.073	1.154	1.05	1.11	1.11	1.07	1.11
2011	1.090		1.07	1.11	1.032	1.107	1.066	1.132	1.03	1.11	1.06	1.09	1.11
1986-91	**1.115**	**1.134**		**1.066**	**1.053**	**1.055**	**1.134**	**1.161**	**1.136**	**1.088**	**1.120**	**1.081**	**1.143**
1993-96	**1.090**	**1.109**	**1.130**	**1.051**	**1.040**	**1.052**	**1.124**	**1.149**	**1.124**	**1.082**	**1.113**	**1.062**	**1.132**
1997-2006	**1.115**	**1.089**	**1.115**	**1.118**	**1.046**	**1.115**	**1.096**	**1.167**	**1.113**	**1.120**	**1.134**	**1.101**	**1.122**
2007-2011	**1.106**		**1.088**	**1.109**	**1.042**	**1.109**	**1.073**	**1.156**	**1.051**	**1.110**	**1.109**	**1.091**	**1.112**
1992-2011	**1.111**	**1.095**	**1.112**	**1.110**	**1.044**	**1.111**	**1.096**	**1.160**	**1.109**	**1.115**	**1.120**	**1.095**	**1.122**

7.8. Conclusion

From the previous discussion I have reached at the conclusion

[1] After reforms, the firms under new management (privatized) and already in private sector has some improvements in cost efficiency

[2] Order-m technical efficiency estimates indicate that on balance, it would appear that the 1992 reforms had some positive impact at least in the initial years. I find that privatized and private firms operated almost homogeneously while public firms operated below the maximum amount they would have achieved. Private firms though, seem to have responded most positively to deregulation. Firm size does matter and large size firms appear to be more efficient compare to small size firms.

[3] The significant improvement occurred in total factor productivity. The period of 1986 to 1990 shows the trend as usual business for all three groups. The major discontinuity occurred in 1990-92, the period of announcement and implementation of privatization and transfers of ownership. Privatized firms experienced a take-off since the announcement of the privatization program and momentum continued afterward. Public sector firms group however, did not show similar performance after reforms and their productivity improvement is marginal. Labour unrest and a state of uncertainty regarding their eventual privatization were one of the several reasons. However, private sector firms experienced the continuous growth in productivity. There were some hiccups for privatized

companies during this period like Zealpak and Dandot Cement had issues with labour and local taxation authorities (Zealpak).

CHAPTER 8

Decomposition of TFP Change and Input Biases

This chapter examines technical change, total factor productivity growth and input bias for the cement industry over the period 1986 – 2011. Returns to scale for private and privatized firms have increased in the post reforms period, as has the rate of total factor productivity growth (particularly since 1997 onward). In addition, it is found that the technical change experienced by the average firms is labour and capital using and fuel and material saving. These results indicate that the measure of deregulation introduced during the early 1990s have had the effect of making average firm more efficient in terms of TFP growth and fuel usage.

8.1. Introduction

Technical change and increases in productivity can have a strongly positive effect upon individual firms, as well as entire industry. When firms are able to take greater advantage of the resources at their disposal, they become more efficient and the market in which they operate becomes more competitive. It should come as no surprise then, that governments and other agents have overseen changes in regulatory and legal frameworks with a view to helping firm better take advantage of technical change and to make factors of production more productive.

Studies on total factor productivity growth in response to deregulation and privatization have been forthcoming in recent years, often prompted by a particular innovation or change within a given industry. Jorgenson (1995) empirically examines TFP growth, as does Salinas-Jiminez *et al.* (2005) within the EU, for example. Such studies in the banking area have seen huge growth in the last few years, due in no small part to the significance of the banking sector upon the growth and stability of an economy.

The number of studies on TFP growth of the manufacturing sectors of developing countries has also increased in recent years. As developing countries often have the greatest potential for rapid economic growth, the efficient operation of the industries to underpin this growth has a greater level of significance attached to it. Most notably, developed countries such as the USA, Europe, and Japan have experienced perceived benefits of deregulation and privatization in the last few decades.

As many developing countries have followed examples from countries like the UK by introducing deregulation and privatization in the later part of the 20th Century, studies on efficiency and productivity can therefore be made more meaningful by focusing on changes from pre- to post deregulation within those countries which stand to benefit the most from improvements in the operation of the industrial sector. When it comes to results of previous studies in regard to effect of privatization policy on firm's efficiency and productivity trends in post reform period, mixed results have been displayed by the literature in this regard

8.2. Literature Review: Estimation of TFP and Components

This chapter seeks to estimate rates of TFP and technical change over the period 1986 – 2011, a period characterized by significant reform in the early 1990s. The TFP methodology has been employed successfully by a number of authors covering a variety of subject areas. A study by Nera (1997) uses a TFP approach to estimate the annual technical change in the gas distribution sector in Argentina in the period 1970 - 1995.

Heshmati *et al.* (1995) investigate the issues of technical efficiency in the Swedish pork industry during the period of 1976-1988. A stochastic frontier production model, with the underlying technology represented by a generalized Cobb-Douglas model is used. The study indicates that technical change is positive but declining during the period 1976-1980 turning into technical regress during the remaining period, 1981 to 1988.

In terms of the methodology employed in TFP studies, Kumbhakar *et al.* (2000) used a 'dual' approach of time trend (TT) and general index (GI) models to analyse 72 Japanese chemical corporations from 1968 – 1987. Simpler functional forms such as Cobb Douglas were rejected by the data. Technical change (TC) was positively correlated with the size of firms. The study concludes that there is a strong, positive correlation between firm size and TC. It is therefore important to allow better plants to get bigger. This has significant implications for analysing and managing merger activity.

Atkinson and Primon (2002) formulate shadow distance and shadow cost systems as approaches to estimating firm technology, allocative efficiency, technical efficiency, and productivity growth, using panel data for 43 US utilities over 37 years. The two models they estimated diagnose an over-use of capital relative to labour and energy and the under-use of energy relative to labour.

Kumbhakar (2002) deals with modelling technical change in U.S. airlines over the period 1970 to 1984 by using a factor augmenting approach, which represents technical change through changes in input efficiency. The study concludes that technical change is found to be both labour and fuel saving (and therefore capital using) for most of the years of the study, whilst scale bias is found to be negative, but very small.

Heshmati (2002) uses data on Swedish Department of Gynaecology and Obstetrics data to estimate productivity by decomposing it into technical change and scale effect. Use of this methods to evaluate the welfare implications of public spending is not new idea but nonetheless very interesting. Several competing models were estimated and results were alarming. It is concluded that these departments were operating extremely inefficiently and evidence was derived of large and negative productivity growth during the sample period.

Estache and Rossi (2004) investigate the impacts of different regulatory environments upon the efficiency of firms. The study indicates that privatized firms operating under price-cap and similar ‘hybrid’ schemes are more efficient in their use of labour than both public firms and privatized firms under rate-of-return regulations, and that privatized firms operating under rate-of-return regulation have, at most, similar labour efficiency as public firms.

Chiang *et al.* (2004) use the technique to estimate potential milkfish farm output and efficiency from a survey into 433 aquaculture milkfish farms covering the period 1997–1999. The study concludes that milkfish farming in Taiwan exhibits diminishing returns to scale.

Some more recent studies to decompose the change in total factor productivity into technical and scale components include Kumbhakar (2004), Oh *et el.* 2008), Heshmati and Kumbhakar (2011a) and Heshmati and Kumbhakar (2011b). All these studies estimated total factor productivity by specifically looking into role of technical change and scale efficiency. Authors concluded that by treating technical change as an exogenous variable could lead to under estimation of productivity improvements or decline. I aim to address this and estimate the total factor productivity of cement industry by using a series of alternative competing models. Results of these alternative models are discussed individually and then LR tests are applied to see the most appropriate specification that fits the data well. In the following section, I discuss the detailed methodology, data requirements, and estimation method and then subsequently, results are derived and discussed alongside their limitations.

8.3. Measurement of Decomposition of Productivity

In my effort to evaluate productivity growth in pre- and post reforms period, I obtained the TFP growth rates by parametric methods. In this regard I follow Oh *et el.* (2008) in term of notations and symbols. Following discussion summarize the theoretical and empirical framework.

8.3.1. Parametric Approaches to Measure TFP

For the measurement of productivity using parametric method, I could start with Kumbhakar *et al.* (1999) method and use the similar notations. Assuming firms are producing single output(y), using combination of inputs (x). The production function could be written as:

$$y = f(x; t) \tag{1}$$

Let say x is a vector of variable inputs (j = 1, . . ., J) and t is the time trend variable accommodating technology. Now by differentiating the above equation (1), I get:

$$\hat{y} = \sum_{j} \frac{f_{xj} x_j}{y} \hat{x}_j + \frac{f_t}{y} = \sum_{j} \varepsilon_j \hat{x}_j + \frac{f_t}{y} \tag{2}$$

Hat over a variable in this case indicates change or growth rate (equivalent of log derivative with respect to time); marginal products of the variable is represented by f_x and input elasticities by ε_j . The above equation could be modified to obtain TFP by assuming that firms intend to minimize cost by using input quantities purchased from the competitive input market. Lot of research has gone to decompose the productivity growth to find the sources of growth. By following seminal work of Denny *et al.* (1981), the TFP growth then can be decomposed into different sources such as:

$$\widehat{\mathrm{TFP}} = \hat{y} - \sum_j S_j \hat{x}_j = \frac{ft}{y} + (\mathrm{RTS} - 1) \sum_j S_j \hat{x}_j \tag{3}$$

where $S_j = \frac{w_j x_j}{C}$ are cost shares; $C = \sum_j w_j x_j$ is the total cost; w_j are input prices; and $\mathrm{RTS} = \sum_j \varepsilon_j$ is the elasticities of scale.

In the above equation, the left hand side can be treated as the TFP growth decomposed into a first component technical change $\frac{f_t}{y}$ and second component scale effect($(\mathrm{RTS} - 1) \sum_j S_j \hat{x}_j$. Empirically, the parameters of the above production functions are first estimated by using output and input quantities and then subsequently used to derive estimates of productivity and its components. In the following discussion, I summarize the specification of my production technology alongside estimation framework.

8.3.2. The Specification of the Production Function

Parametric methods to estimate production technology have become very popular due to their ease of specification, estimation and robustness. By specifying and estimating the production function using parametric methods, researchers could obtain some interesting statistics such as returns to scale, total productivity growth (TFP), input elasticities, rate of technological progress or regress (usually termed as technical change), and biases in input use and scale due to technical change.

There exists a variety of empirical models that could be used for the estimation of production parameters i.e. time trend (TT) model and the general index (GI) model of Baltagi and Griffin (1988). There had been some extensions of these two models. For example, by introducing firm specific parameters, one could extend GI models. Another, extension proposed and implemented by some authors is such that firm specific parameters are not completely free but some parameters are constrained to be the same for all inputs and output. In my empirical section I use these two basic models, their extensions by Lee and Schmidt (1993) alongside the models proposed by Stevenson (1980) and Cornwell *et al.* (1990). For details discussion of these extensions and formulation, see Tveterås and Heshmati (2002).

The estimation framework of simple time trend model (TT) is straightforward. In this model, the time trend variable is specified as one of the regressor alongside input quantities and other variables representing the production characteristics. In term of choice of functional form, I choose the popular translog production function, satisfying the usual symmetry and convexity conditions. The model could be specified as:

$$\ln y = \alpha_0 + \sum_j \alpha_j \ln x_j + \alpha_t t + \frac{1}{2}\left\{\sum_j \sum_k \alpha_{jk} \ln x_j \ln x_k + \alpha_{tt} t^2\right\} + \sum_j \alpha_{jt} \ln x_j t \tag{4}$$

Contrary to TT model, the continuous time trend variable t is replaced by vector of yearly dummies $A(t)(t = 1, \dots, T)$ in the general index (GI) model of Baltagi and Griffin (1988). By using similar translog functional, the general index GI model is written as:

$$\ln y = \alpha_0 + \sum_j \alpha_j \ln x_j + A(t) + \frac{1}{2}\sum_j \sum_k \alpha_{jk} \ln x_j \ln x_k + \sum_j \alpha_{jt} \ln x_j A(t) \tag{5}$$

8.3.3. Derivation of Firms' Performance Statistics

By utilizing TT and GI models mentioned above, I could obtain a number of interesting and valuable statistics to assess firms' performance over time. Following are the main statistics I calculated and presented in my empirical section.

Technical change (TC)

The technical change index is obtained by taking the derivatives of TT and GI index specifications (equation (4) & (5)) with respect to time expressed as:

$$TC_{TTI} = \alpha_t + \alpha_{tt} + \sum_j \alpha_{jt} \ln x_j \tag{6}$$

$$TC_{GII} = \{A(t) - A(t-1)\}\left\{1 + \sum_j \alpha_{jt} \ln x_j\right\} \tag{7}$$

Technical change could further be divided into pure (neutral) and non-neutral components. These components in the TT model (TTI) are $\alpha_t + \alpha_{tt}t$ and $\sum_t \alpha_{jt} \ln x_j$. Similarly, in the case of GI model these components are, $\{A(t) - A(t-1)\}$ *and* $\sum_j \alpha_{jt} \ln x_j \{A(t) - A(t-1)\}$.

Technical Change and Input Bias

As a consequence of technological change, firm could save some inputs and in some cases substitute one with the other. More or less use of a particular input j termed as bias (B_j) in technical change can be measured by taking derivative of cost share of the input j (S_j) as: $B_j = \partial S_j / \partial t$. A positive value of B_j would indicate that firms are using more of this input as a result of technological change. A negative value on the other side would be indication of firms saving this input after change in technology. Oh *et al.* (2008) suggested that technical change in manufacturing would lead to firms using capital and material but saving labour and fuel and energy.

Due to the way TT production function model is specified, input bias is constant for all time periods ($B_j = \alpha_{jt}$) and is both firm- and time-invariant. Contrarily, in the GI model, bias varies over time and is calculated as: $B_j = \alpha jt\{A(t) - A(t-1)\}$.

Technical Change and Scale Bias

Scale bias in technical change is another interesting statistics that could be obtained from TT and GI model. This is calculated as $SB = \partial RTS/\partial t$. In the TT model, the scale bias is calculated by $S_{BTTI} = \sum_j \alpha_{jt}$ which does not change over firms and time periods. In the case of GI model, $SB_{GII} = \{A(t) - A(t-1)\} \sum_j \alpha_{jt} lnx_j$

Total Factor Productivity Change (TFP)

Using the above equations (3) and (4), TFP growth $(T\hat{F}P)$ in the time trend model (TT) is calculated from the following:

$$T\hat{F}P_{TTI} = TC_{TTI} + (RTS - 1)\sum_J \mathcal{E}_j \hat{x}_j \tag{8}$$

where $\mathcal{E}_j$ are input elasticties which are substituted for the input shares in equation (3):

$$\mathcal{E}_j = \frac{\partial lny}{lnx_j} = \alpha_j + \sum_k \alpha_{jk} lnx_k + \alpha_{jt} t \tag{9}$$

TFP growth in the GI model is calculated in a similar fashion by replacing the time trend (t) in equation (9) with a vector of time dummies, A(t).

8.4. Data

The results for this chapter are generated using panel data on cement firms covering the period 1986 – 2011. Output is measured as gross sales (domestic as well as exports). Four factor inputs are used in the production function that includes labour, capital, raw material (limestone), and fuel. Value of fixed assets is treated as a stock of capital. Due to significant capacity additions in post reforms period, this proxy is appropriate and justifiable. All monetary values are converted into real values by using relevant price indices.

8.5. Estimation and Explanation

In common with Kumbhakar *et al.* (1999, 2000), I estimated seven different models. The estimates of R^2 showed a good explanatory power of different models (R^2 values exceeding 0.9 for almost all models specifications). After carrying out tests (LR and J) on nested and non nested models, my best model turns out to be extended general index model (gi1). These tests are although very useful in deciding the best suited model for the data being used but suffer due to non-symmetric nature and the lack of power if the sample is not large enough. For details of these test and procedure used to perform these tests on a variety of non-nested models, see Kumbhakar *et al.* (1999). Within these specifications, a majority of the estimated production function parameters are found to be statistically significant at the conventional 5% level of significance, whilst simpler model specifications such as Cobb-Douglas are rejected in favour of translog by the data structure. As my main objective is to find out the impact of reforms on the productivity of firms and its components, I present these estimates evaluated at the mean values of inputs stratified by the different classes of ownerships. This would help in differentiating the change of ownership effect from the overall business conditions of the time.

8.5.1. Returns to scale

Industry

Table 8.1 displays results from the various model specifications relating to returns to scale. An analysis of the trend of RTS estimates over time show a general mixed trend, with overall industry RTS greater than one for most of the specifications indicating increasing returns to scale across the years of the study. Despite of the fact that there is evidence of increasing returns to scale for the overall industry, the margin of improvement is term of choosing the optimal scale of operation is no big enough. For almost all the specifications, RTS estimates are not for away from one. Hence, on the average, firms in my sample were operating close to optimal scale of production. This is more evident from the RTS estimates derived from my preferred flexible GI model (gi1).

Looking at individual model specifications, it appears that the gi2 and extension of gi0 (gi0_1) models displays the highest estimates of RTS over the sample period. The median for the gi2 measure of returns to scale for all firms is 1.085 – the highest of the seven. The minimum median value was 0.986, with the other values lying between two values for different specifications.

In terms of a breakdown of RTS among all firms between the different significant time periods of the study (pre- reforms: 1986 – 1991, immediate period of post reforms: 1992-96, second phase of broader reforms and strengthening of regulatory authorities: 1997-11), it can be seen by looking at different specifications of the models that there are not uniformly higher returns to scale in the post reform periods as opposed to the earlier pre- reforms time period. This seems to indicate that the deregulation and reform that has taken place in the 1990s has had a mixed effect on returns to scale. The greatest difference between the two median values is once again displayed by the two models gi2 and gi0_1, which not only estimates the highest levels of returns to scale among firms, but also indicates the greatest difference between returns in pre- and post deregulation periods. By concentrating only on RTS estimates calculated from my preferred gi1 model, there is evidence of increasing returns to scale for the industry (estimates are 0.955 for pre- reforms and 1.019 for the post reforms period).

Public Firms

RTS estimates for the public sector firms appear to be consistently higher than industry averages. This could indicate that these firms operated at sub-optimal scale compared to competitors. One reason could be the fact that these firms may have location disadvantages as well as using less efficient technology of production. Contrary to overall industry, public sector firms experienced decrease in returns to scale with downward trend since 1997 onward. The decrease in returns to scale is surprising given the fact that most of scale efficient firms probably may have been privatized in 1991. Although different models specifications show a significant variations in estimates but the trend is clear (five out of seven specifications indicating decreasing returns to scale). In terms of a breakdown of RTS among all public sector firms between the different significant time periods of the study (1986 – 1991 and 1992 – 2003,1992 - 96 and 1997 - 03), it can be seen that there are not generally increasing returns to scale in post deregulation time periods particularly since 1997 onward as opposed to the earlier time period. This seems to indicate that the deregulation and reform that has taken place in the 1990s has had a positive overall effect on returns to scale and the firms started operating at comparatively optimal scale of production. This is probably due to the fact that these firms were placed in a better position to take advantage of returns to scale as a result of liberalisation taking place in the early 1990s.The gi1 model estimates indicate increasing returns to scale for the period 1997 to 2003.

Private Firms

These results are much the same as those obtained for overall industry in term of magnitude of the RTS estimates. However, the estimates display an upward trend over the years in investigation. This is reflected in the sample median values separated over time periods for different specifications. Almost all specifications models except st predicted an overall increase in RTS over time. It seems that in common with overall industry, returns to scale for those firms operating under private ownership in pre and post privatization have increased over time particularly during 1997 to 2011. This is not surprising given the fact that these firms started their operation with better technology (dry process) or upgraded the old operation immediately after reforms so that these firms could compete with privatized firms.

Privatized Firms

Similar to industry estimates, different models specifications show a mixed trend in returns to scale immediately after privatization –It would appear that the deregulation in the early 1990s had the mixed effect upon firms with privatized ownership. Hence, unlike the private ownership type, it appears that returns to scale have been rather erratic for firms with privatized ownership (this is in contrast to the gentle, upward trend observed for private firms).

Table 8.1: Returns to Scale (RTS) by Ownerships

	tt	gi0	gi1	gi2	st	css	gi0_1
Industry							
Overall	1.069	1.052	0.986	1.085	1.005	1.034	1.085
1987-91	1.074	1.059	0.955	1.080	1.106	1.002	1.113
1992-11	1.054	1.043	0.994	1.090	0.993	1.046	1.079
1992-96	1.080	1.039	0.962	1.063	1.010	1.027	1.073
1997-11	1.043	1.047	1.019	1.101	0.989	1.055	1.085
Public							
Overall	1.095	1.066	1.000	1.090	1.086	1.093	1.108
1987-91	1.098	1.067	0.954	1.090	1.116	1.006	1.137
1992-03	1.075	1.030	1.018	1.079	1.044	1.108	1.091
1992-96	1.112	1.099	1.003	1.152	1.092	1.103	1.094
1997-03	1.069	1.019	1.029	1.034	1.036	1.114	1.011
Private							
Overall	1.038	1.041	0.996	1.102	0.968	1.042	1.050
1986-91	1.018	1.026	0.978	1.081	1.112	0.998	1.013
1992-11	1.043	1.045	0.998	1.104	0.960	1.046	1.059
1992-96	0.973	0.980	0.995	1.063	0.898	1.041	1.010
1997-11	1.051	1.051	1.007	1.114	0.980	1.046	1.103
Privatized							
Overall	1.049	1.043	0.997	1.087	1.008	1.024	1.076
1992-11	1.049	1.043	0.933	1.087	1.008	1.024	1.076
1992-96	1.065	1.048	0.997	1.052	1.010	0.993	1.131
1997-11	1.042	1.043	1.028	1.097	0.996	1.040	1.070

8.5.2. Technical Change (TC)

Industry

Table 8.2 displays results indicating the rate of technical change for different ownership firms. Technical change for all firms has been relatively stable and positive, in the immediate period of deregulation (1992-96) as well as more mature period such as 1997 to 2011. The GI specification models show a relatively sharp increase after the mid-1990s, with positive technical change experienced in most of the years in late 1990s and 2000-11. This technological progress is more or less echoed in the all specification models, with overall positive technical change estimated in the early and later period of deregulation. The positive periods of technical change seem to be concentrated around 1997 to 2011 irrespective of the model choice, which is the periods of broader post reform in the manufacturing and financial sectors. In terms of the pre and post deregulation time periods analysed by the study, all seven of the models appear to indicate a greater positive technical change in the post deregulation. Again, the majority of results seem to indicate that, overall, there has been a greater rate of technical change in the post deregulation period as opposed to the pre-deregulation period and the positive trend post-2000 could serve to encouraging case for pro reform conclusions.

Public

The rate of technical change for public sector firms does not seem to follow similar magnitude but same pattern of overall industry. Almost all the models show a positive technical change for public sector firms over the most of the period of the study. Indeed, the median values of overall technical change according to different models specifications are overall positive but with significant differences across different model specifications. The negative estimates of technical change put forward by the gio and gi2 models seem to be concentrated during 1986 -1991. In terms of comparison between the pre and post deregulation periods, five out of seven models specifications indicate a higher rate of technical change in the later period of the deregulation period (1997 and onward) as opposed to the early period (1992-96). Overall, in comparison to industry average, rate of TC is lower in at least five out of seven specifications. Again this overall result is not surprising for this group of firms due to the fact that these firms were operating with relatively less modern technology of production. The intention of the government was to sell these firms rather than injecting huge amount of money on modernization and upgrades.

Private

The positive technical change (around 4% to 5% per annum) for this group of firms is concentrated in both pre- and post deregulation period according to different specifications. The median values show overall positive technical change for the period under analysis from almost all models. In common with overall industry, it would appear that the rate of positive technical change has come immediately post deregulation and continued throughout the sample period, showing a significant improvement. It would appear that the deregulation and privatization measures introduced during the 1990s have had the effect of accelerating the rate of technical change amongst already privately owned firms too.

Privatized

The results displayed here are more in keeping with results obtained from private ownership type. There appears to be a relatively stable, rate of technical change which tends to be in the range of 3% to 5%. This is estimated by all seven model specifications. There again is an observable improvement in median values estimated immediately after privatization (1992-96) compared to less than satisfactory performance of these firms under public ownership. Similar to other firms, the period of 1997 to 2011 seem to be the one when more impressive positive technical change was achieved.

Table 8.2: Rate of Technical Change (TC) by Ownerships

	tt	gi0	gi1	gi2	st	css	gi0_1
Industry							
Overall	0.029	0.039	0.000	0.044	0.031	0.038	0.029
1987-91	0.006	-0.011	0.000	-0.024	0.004	0.024	0.000
1992-11	0.037	0.045	0.030	0.057	0.041	0.039	0.045
1992-96	0.019	0.028	0.000	0.057	0.017	0.024	0.022
1997-11	0.043	0.046	0.055	0.056	0.045	0.040	0.059
Public							
Overall	0.017	0.023	0.000	0.022	0.026	0.038	0.019
1987-91	0.007	-0.010	0.000	-0.024	0.003	0.033	0.015
1992-03	0.031	0.029	0.001	0.036	0.033	0.040	0.021
1992-96	0.016	0.023	0.000	0.045	0.026	0.039	0.019
1997-03	0.034	0.030	0.076	0.026	0.044	0.040	0.022
Private							
Overall	0.028	0.041	0.000	0.044	0.030	0.035	0.038
1986-91	0.005	-0.012	0.000	-0.026	0.007	0.013	-0.024
1992-11	0.037	0.045	0.030	0.058	0.036	0.044	0.040
1992-96	0.018	0.028	0.000	0.060	0.016	0.019	0.034
1997-11	0.042	0.047	0.053	0.057	0.043	0.044	0.058
Privatized							
Overall	0.038	0.046	0.030	0.060	0.044	0.038	0.026
1992-11	0.038	0.046	0.000	0.060	0.044	0.038	0.026
1992-96	0.022	0.029	0.030	0.060	0.017	0.034	-0.002
1997-11	0.043	0.047	0.055	0.060	0.048	0.040	0.026

8.5.3. Total Factor Productivity Change (TFP)

Overall

Table 8.3 shows total factor productivity estimates using each of the model specifications discussed above. The contribution of scale component to TFP growth (explained later) can be derived by taking the difference between TFP growth and TC growth. Interestingly, there does appear to be some significant TFP growth for the overall industry. It would seem that industry had witnessed a significant productivity growth in post reforms period compared to pre- reforms period. Overall, for a majority of models (five out of seven), there does not appear to be a significant variations in the estimates of TFP growth between different models formulations. If broad conclusions are to be drawn, then gi2 model has the highest overall estimated median rate of TFP growth. There does appear to be consistent negative growth or zero change in productivity in pre- reform period, as is evident from the results of the different model specifications.

Overall, the sample medians show that, for all model specifications, the rate of TFP growth is positive and higher in post deregulation than pre deregulation. There does seem to be significant differences in the size of the change between different model specifications. This indicates that the deregulation taking in the early 1990s has prompted an increase in TFP growth (growth rates ranging from 3% to 5.7% p.a. during 1997 to 2011). One interesting finding derived from out gi1 model indicates immediate impact of reforms was negligible but more pronounced since 1997

Public

In contrast to results above, there seems to be a less impressive picture for this group of firms. Overall, for a majority of time periods, there does appear to be a huge difference in the estimates of TFP growth between different model specifications, although if broad conclusions are to be drawn, then css model has the highest estimated median rate of TFP growth for all public sector firms. There does seem to be consistent ‘negative’ or zero growth in pre reform period from the results of the different model specifications (based on five out of seven models estimates). Three out of seven model specifications indicate positive overall TFP change over the entire period, and once again, on average, a greater rate of TFP change post deregulation (1.5% to 2.5% growth p.a.). The extent of such a change differs remarkably according to the model specification used: the gi1 specification, for example, estimates only a modest increase in TFP growth between the two time periods, whereas the gi0 and css specifications estimate the largest change during 1997 to 2003 compared to 1987-91.

Private

Total factor productivity growth estimates for privately owned firms using each of the model specifications discussed above indicates an interesting trend probably similar to overall industry. The results here are strikingly different than for public sector firms. All model specifications show positive and significant TFP growth rates on average across the post deregulation period. The rate of change observed between time periods is almost similar across different specifications. All of the model specifications provide median rates of TFP growth in the post-deregulatory period which are higher than those of pre- reforms median values for public firms. This indicates that privately owned firms have benefited in terms of TFP growth in the post-deregulatory period, more so than firms who remained in public ownership until 2003.

Privatized

For this group of firms, broadly speaking, there appears to be similar trend in the productivity growth observed for privately owned firms. Majority of change in productivity has come during 1997 to 2011. This is similar to the findings of Bonin *et al.* (2005) who concluded that privatized-owned firms operating within transition economies tend to display greater all round efficiency than other domestic firms. Interestingly, though, immediate effect of privatization (1992-96) is evident from the positive growth estimates compared to dismal performance by these firms operating under public ownership.

Table 8.3: Total Factor Productivity Growth (TFP) by Ownerships

	tt	gi0	gi1	gi2	st	css	gi0_1
Industry							
Overall	0.030	0.038	0.003	0.041	0.033	0.031	0.017
1987-91	0.008	-0.012	0.000	-0.024	0.001	0.025	0.005
1992-11	0.034	0.041	0.029	0.059	0.037	0.036	0.025
1992-96	0.018	0.031	-0.001	0.061	0.017	0.029	0.019
1997-11	0.038	0.042	0.051	0.057	0.041	0.037	0.031
Public							
Overall	0.012	0.001	0.001	-0.003	0.014	0.033	-0.001
1987-91	0.007	-0.013	0.001	-0.025	0.002	0.027	0.012
1992-03	0.015	0.028	0.001	0.021	0.019	0.034	-0.032
1992-96	0.015	0.031	-0.002	0.047	0.015	0.039	-0.001
1997-03	0.014	0.025	0.001	0.004	0.025	0.029	-0.063
Private							
Overall	0.030	0.037	0.011	0.038	0.036	0.033	0.028
1986-91	0.007	-0.011	-0.001	-0.019	0.001	0.017	-0.025
1992-11	0.033	0.046	0.029	0.051	0.039	0.035	0.031
1992-96	0.017	0.031	-0.003	0.063	0.021	0.018	0.021
1997-11	0.039	0.050	0.051	0.046	0.040	0.043	0.041
Privatized							
Overall	0.033	0.041	0.026	0.063	0.035	0.033	0.011
1992-11	0.033	0.041	-0.001	0.063	0.035	0.033	0.011
1992-96	0.022	0.031	0.026	0.062	0.018	0.020	0.015
1997-11	0.038	0.042	0.043	0.064	0.046	0.033	0.008

8.5.4. Scale Effects

Overall

Table 8.4, below, shows scale effects over time (calculated as the difference between TFP and TC), estimated once again with the different model specifications. All seven specifications results are not broadly consistent. Overall, the magnitude of scale component in the total factor productivity is extremely low compared to contribution of technical change. My more flexible gi1 model estimates indicate that, for a majority of the second phase of reforms time periods (1997 onward), the minimum efficient scale actually fell. It would also indicate the gaining of market share by larger firms and hence market becoming less competitive over time. It is interesting to note that these increases occur in periods surrounding manufacturing and financial reforms – the early 1990's (around 1991-92) and the late 1990s (around 1997).

Public

Table 8.4 shows scale effects for public sector firms. Overall, again, by looking at gi1 specification and 1997 onward time period, the scale effect is positive for post reform period; indicating that the minimum efficient scale (MES) among public sector firms actually fell, again concentrated in the mid to late 1990s and early 2000s.

Private

Once again, the gi1 model specification displaying recurring positive values since 1997 onward, implying decrease in the minimum efficient firm size over time. This preferred specification reveal higher positive median scale effect values over the entirety of the post reforms period – supporting the observation that the MES for private firms has been falling. This effect seems magnified since 1997 onward, indicating a greater reduction in the MES as a result of the modernisation of the industry. Interestingly, the gi1 model estimates a negative median value for the pre-deregulatory period, indicating an increase in MES for private firms before deregulation and privatization.

Privatized

Table 8.4 shows scale effects for privatized firms. Two models specification namely gi1 and gi2 show positive values for the period 1997 onward, a decrease in minimum efficient size during this time period. The median values are significantly higher post-deregulation, indicating that the reduction in MES in the latter period of the post reform was far higher and more pronounced than in the first major time period of the post reform (1992-96). Again, the impact of reforms experienced by private and publicly owned firms, seem to have been shared to the same extent with privatized firms.

Table 8.4: Scale Effects by Ownerships

	tt	gi0	gi1	gi2	st	css	gi0_1
Industry							
Overall	0.001	-0.001	0.002	-0.002	0.002	-0.007	-0.013
1987-91	0.002	-0.002	0.000	0.000	-0.003	0.001	0.005
1992-11	-0.003	-0.004	0.029	0.002	-0.003	-0.004	-0.020
1992-96	-0.001	0.003	-0.056	0.004	0.000	0.005	-0.003
1997-11	-0.005	-0.004	0.021	0.001	-0.004	-0.003	-0.029
Public							
Overall	-0.005	-0.022	0.001	-0.025	-0.012	-0.004	-0.021
1987-91	0.000	-0.003	0.001	-0.001	-0.001	-0.006	-0.003
1992-03	-0.016	-0.001	0.001	-0.015	-0.013	-0.006	-0.053
1992-96	-0.001	0.008	-0.078	0.002	-0.011	0.000	-0.021
1997-03	-0.019	-0.005	0.000	-0.022	-0.019	-0.011	-0.085
Private							
Overall	0.002	-0.004	0.036	-0.006	0.006	-0.002	-0.010
1986-91	0.002	0.001	-0.011	0.007	-0.006	0.004	-0.001
1992-11	-0.004	0.001	0.046	-0.008	0.003	-0.008	-0.008
1992-96	-0.001	0.003	-0.021	0.003	0.005	-0.001	-0.014
1997-11	-0.003	0.003	0.020	-0.010	-0.003	-0.001	-0.017
Privatized							
Overall	-0.004	-0.004	-0.005	0.003	-0.009	-0.006	-0.016
1992-11	-0.004	-0.004	-0.001	0.003	-0.009	-0.006	-0.016
1992-96	-0.001	0.001	-0.029	0.002	0.001	-0.013	0.018
1997-11	-0.005	-0.005	0.013	0.004	-0.001	-0.006	-0.018

8.5.5. Elasticities and Factor Input Biases

Elasticities

Table 8.5 shows the input elasticities and technical input biases. Average elasticities of labour and capital are very low. This is not surprising given the fact that role of labour is not significant in the cement manufacturing due to automation of significant number of jobs. The low capital elasticity in particular is similar to studies relating to manufacturing industry (see for example, Oh *et al.* (2009)) but confusing due to significant investment made in the up-gradation of plants. I would have expected that the response of output to change in this factor would have been more profound compared to what is estimated here.

In regard to low eslasticity of capital few authors such as Mairesse and Jaumandreu (2005) suggested that this is a universal issue in estimating production functions. This low elasticity could be due to variety of reason including inaccuracy in calculating capital variable and not taking into account the idle capacity. It also reflects the fact that the industry uses capital intensive technology and would not find it easier to replace this with labour or other factor of production. Fuel elasticity value of 0.65 is consistent with the cost share of this factor of input. It accounts for more than 50% of the total cost. My estimates are though lower than Kumbhakar *et al.* (1999) estimates (> 0.8) for the Swedish cement industry. High value of material input elasticity is also consistent with other studies of the manufacturing industry. Further, material input to some extent is truly the only variable input and is generally more closely associated with output compared to other inputs.

In term of patterns of these elasticities over time, fuel elasticity reduced from 0.66 in pre- reforms period to 0.567 during 1997-2011, primarily due to change of fuel mix from furnace oil to coal for the firms operating under private ownership. For labour elasticity, though I observe very erratic pattern and in some cases wrong sign (negative). Capital and material elasticities appear to be stable and no significant difference is found across different ownerships.

Table 8.5: Industry: Input Elasticities and Biases

	Elasticities				Input/Output Biases			
	Overall	Public	Privatised	Private	Overall	Public	Privatised	Private
Labour								
Overall	0.000	-0.003	0.041	-0.003	0.000	0.000	0.015	0.000
1987-91	-0.009	-0.003		-0.007	0.000	0.000		0.000
1992-96	-0.024	-0.012	-0.019	-0.045	0.000	0.000	0.000	0.000
1997-11	0.106	0.020	0.105	0.121	0.027	0.024	0.027	0.027
1992-11	0.037	-0.006	0.041	0.031	0.015	0.000	0.015	0.015
Fuel								
Overall	0.658	0.668	0.641	0.668	0.000	0.000	-0.011	0.000
1987-91	0.660	0.658		0.682	0.000	0.000		0.000
1992-96	0.676	0.677	0.665	0.695	0.000	0.000	0.000	0.000
1997-11	0.567	0.695	0.617	0.562	-0.019	-0.017	-0.019	-0.019
1992-11	0.638	0.694	0.641	0.636	-0.011	0.000	-0.011	-0.011
Capital								
Overall	0.080	0.085	0.083	0.077	0.000	0.000	0.002	0.000
1987-91	0.089	0.092		0.102	0.000	0.000		0.000
1992-96	0.079	0.082	0.085	0.073	0.000	0.000	0.000	0.000
1997-11	0.075	0.078	0.080	0.074	0.003	0.003	0.003	0.003
1992-11	0.077	0.080	0.083	0.074	0.002	0.000	0.002	0.002
Material								
Overall	0.235	0.242	0.232	0.236	0.000	0.000	-0.001	0.000
1987-91	0.233	0.233		0.226	0.000	0.000		0.000
1992-96	0.232	0.255	0.208	0.241	0.000	0.000	0.000	0.000
1997-11	0.238	0.232	0.240	0.240	-0.002	-0.002	-0.002	-0.002
1992-11	0.235	0.254	0.232	0.240	-0.001	0.000	-0.001	-0.001

Input Biases

Industry

Table 8.5, also displays technological input bias calculated using the flexible gi1 model, which accommodates time specific trends. TC, on the average is found to be labour and capital using and fuel and material saving. Capital using results are expected (see Kumbhakar *et al.*, 1999) due to the nature of industry (capital intensive). For an energy intensive industry such as cement manufacturing, I would *priori* expect a strong energy saving bias (Førsund and Hjalmarsson, 1983), and this is confirmed by my estimates of the bias. Interestingly, though, immediately after reforms that include shedding of labour through golden handshake, firms did not experienced saving in labour as per this model. This is not surprising results given the fact that a significant number of workers were rehired on contract basis to avoid benefits and social security contributions. Contract workers provide more leverage to firms in firing these workers if the demand conditions change. Fuel saving is understandable given the fact that fuel cost contributes significantly in the overall cost of production (more than 50%) and industry has shown to be moving from furnace oil to coal. In years of negative output growth, firms would be expected to conserve fuel cost, as opposed to labour, hence, a fuel saving technical change.

Public

Table 8.5, below, also displays technological input bias for public sector firms, once again calculated using the more flexible models specification gi1. In common with the results for industry, TC is found to be fuel and material saving for those firms in the public sector. The opposite is true for labour, and capital, where TC is labour, and capital using. Again due to high proportion of fuel in overall cost of production, this result is not surprising. In comparing the pre to post deregulation periods, I can see that TC became less fuel and material using (converting from furnace oil and electricity to coal), whereas TC becomes more labour and capital using. This indicates that as a result of deregulation, public sector firms have started to use proportionally more labour and capital and less fuel to reduce fuel bill.

Private

TC is once again found to be fuel and material saving, and labour, and capital using for this group of firms. Private firms have become slightly fuel saving post deregulation period (particularly during 1997 onward), and slightly more labour using. There is little to differentiate between publicly and privately owned firms in this respect.

Privatized

Results are similar to those determined above in terms of use and or saving of inputs. TC is found to be labour and capital using during 1997 to 2011 and is fuel and material saving. Absolute values are comparable to other types of ownerships.

8.5.6. Firm Size and Performance

I use flexible model (gi1) to observe the performance of the firms according to five different classes of sizes. As per expectation, very small size firms would benefit by increasing their scale of production evident from the results. Very large firms on the other hand, do not have this option available. Middle size firms on the other hand, are operating at optimal scale of production. This group of firms also experienced significant technical change, the main contributor in the TFP growth. This group of firms also looks to be one performing significantly better in term of productivity growth.

Table 8.6: Returns to Scale, TFP and Components by Firm Size

	Very Small	Small	Medium	Large	Very Large
Baltagi & Griffin (gi1) model					
RTS	1.033	1.005	0.993	1.033	0.931
TC	0.013	0.019	0.037	0.017	0.000
SE	0.010	0.010	0.002	0.009	-0.006
TFP	0.003	0.010	0.035	0.009	0.006

8.6. Conclusion

This chapter has examined technical change, total factor productivity growth and scale bias for the cement industry over the period 1986 – 2011 – a period characterised by substantial modernisation, liberalisation and privatization of the cement sector. It was found that firms have largely benefited from the changes implemented during the deregulation of the early 1990s.

Returns to scale for the industry and private firms have increased in the post reforms period, as has the rate of total factor productivity growth (particularly since 1997 onward). In addition, it is found that the technical change experienced by the average firm is labour and capital using and fuel and material saving. These results indicate that the measure of deregulation introduced during the early 1990s have had the effect of making average firm more efficient in terms of TFP growth and fuel usage.

When the results are disaggregated, further conclusions become apparent. Privatized, public and private owned firms seem to have benefited from the deregulation in the ways described above. It appears therefore that privatized firms have enjoyed the benefits experienced by other types of firms as a result of deregulation and indeed have been impacted positively in the form of positive rates of TFP growth and technological change.

It therefore appears, that the measures introduced in the early 1990s have been modestly successful at least in term of productivity growth – firms in general have become relatively more productive. If these changes have been introduced in order to achieve this outcome, then they have been to some extent partially successful. However, if the intention was to improve the efficiency and competitiveness of all firms operating in the industry, more needs to be done to ensure all types of firm ownership are able to benefit equally from reforms.

CHAPTER 9

Labour Use Efficiency Estimation

A significant number of empirical case studies in 1970s and 1980s concluded that state-owned-enterprises (SOEs) were inherently inefficiency due to over employment in these firms. It was believed that politicians and governments use these firms to seek political rents by forcing them to employ inefficient, incompetent and less productive workforce. One of the objectives of deregulation and privatization policy was to let the management decide about the composition and size of workforce. Chapter 9 deals specifically with the modelling and estimation of labour use efficiency and wage elasticities. Labour demand function is estimated by introducing risks in production process. Labour use efficiency scores are calculated and interpreted in pre- and post privatization periods. Efficiency scores are modelled against a number of economic and firm specific factors to detect the sources of labour use efficiency.

9.1. Introduction

Firms need to use their inputs at an efficient rate to maximise profitability and to survive in under competitive conditions. Therefore, if a firm is using more labour in the production process than is technically required, it will be operating below the 'frontier' of efficiency. Policy makers and academics alike take a keen interest when these relative levels of inefficiency are displayed consistently. Studies of labour use efficiency have focused upon manufacturing, agricultural and lately banking industries (see Haouras *et al.* (2003), Okten and Arin (2006) and Liefert *et al.* (2005), Kumbhakar and Hjalmarsson (1995), El-Gamal and Inanoglu (2005), Jaffry *et al.* (2008) and Das *et al.* (2009), for studies examining labour use efficiency in Tunisian manufacturing, Russian agriculture, Turkish manufacturing, Swedish social insurance offices, Turkish banking industry, and Indian manufacturing industry).

Of those studies that have looked into labour use, efficiency and layoff, many focus on calculating and interpreting ratios such as profit per employee, assets per employee and number of employees in pre and post privatization/deregulation sub-period and to some extent related to developed countries such as the Swedish banking sector, analysed by Battese *et al.* (2000), Heshmati (2001) and Gjirja (2004), mainly due to the ease of data availability). As a result, detailed econometric investigation into the labour use efficiency in pre and post privatization period for a developing country such as Pakistani manufacturing sectors has been relatively ignored.

This study seeks to looks into labour use efficiency in both pre and post deregulation period in cement industry in response to privatization and other macro economic reforms observed in over the course of the 1990s. These policies were designed to give firms the ability to adjust their use of labour through layoffs and golden handshake schemes to become more efficient, they also aim to make the industry more competitive. If firms are able to adjust their labour use in accordance to competitive level then they would have been successful in moving closer to the efficiency frontier in order to be able to survive the increased competitive pressures which should result from increased levels of competition. I employ a panel data set, comprising of data from cement industry over the period between 1986 and 2011. This study period represents 4-5 business cycles and would provide a comprehensive picture of adjustments in labour use in post deregulation/privatization period. Specifically, a majority of similar types of studies mentioned above have not used a data set that encompasses the full range of significant periods of reform.

9.2. Estimation of Labour Demand Function - Methodology

The use of a flexible translog functional form to estimate the labour demand function has been fairly common after its use in Christiensen *et al.* (1971) (see Benjamin (1992), Heshmati (2001) and Bhandari and Heshmati (2005) for a selection of examples). The demand for labour is expressed in term of input requirement function of Diewert (1974) as:

$$h = f(y, w, q, z, t)\exp(\varepsilon) \qquad (1)$$

$$\varepsilon = \mu + v$$

Where h is units of labour measured in hours, f represents the production technology, y represents output produced using labour, w is hourly wage rate, q represents fixed input such as fixed assets (production capacity in my case), z represent firm's heterogeneity in term of technology constraint, cost structure and labour requirements (in my case dry or wet process represented by (age) of the firm, as older firms used wet process), exporter firms (exporter) and public sector ownership firms (public)). I aim to capture this heterogeneity in input requirement by including three variables i.e. dummy variable for exporter, log of age of the firm and dummy variable=1 if firm belong to public sector. Age could also be a proxy of historical baggage of starting operation in relatively less competitive environment with excessive employment enforced upon government for political gains, and t represents the time effect in the form of time dummy variables. Overall, this function estimates the minimum amount of labour required to produce a given level of output. The error term in this equation is decomposed into two distinct parts (μ and) as per the seminal paper by Aigner *et al.* (1977), representing technical efficiency and factors beyond the control of firm respectively. In addition to these two, the firm's production technology will also have an effect upon their demand for labour.

If the μ component of the error term for any observation is greater than zero, the firm displays a level of technical inefficiency, meaning that the specific firm has used more labour than was technically necessary in order to produce a given level of output. A firm, which displays a μ value of zero, can claim to be fully efficient in the use of labour. The component of the error term can be both positive and negative. Due to its presence, therefore, the labour demand frontier is stochastic even when μ is set to zero.

If one includes risks in the requirement functions, then the model is redefined appropriately as per the work of Just and Pope (1978), where accounting for both the mean and variance of output will have an effect upon efficiency.

When doing so, the model then becomes:

$$h = f(x;\alpha)\exp(g(x;\beta)\varepsilon) \qquad (2)$$

Where x = (y,w,q,z,t), with f(x;α) representing the demand part and representing the employment variance part of the demand function. The model can also be re-specified in log linear form as[37]:

$$\ln h = \ln f(x;\alpha) + g(x;\beta)\varepsilon \qquad (3)$$

9.3. Data

Historical data on output, inputs quantities, prices and firms characteristics were obtained through company annual reports, site visits, interaction with government ministries, personal contacts and telephone interviews with concerned regulatory authorities and associations.

The final panel dataset used in this chapter comprises information from 1986 to 2011 for public sector companies before their eventual privatization in 1991/92 and beyond and private sector companies. Hence, my data set covers 98% of the industry in pre as well as post privatization period. I dropped less than 1% of observations due to abnormal values (outlier) before the estimation stage. The panel is unbalanced, as not all firms were in existence during all of the sample years encompassed by this study. As many private firms began their operations in post 1991 period. Summary statistics of the data are presented in Table 9.1 below.

[37] For further detail on the estimation of efficiency and input-output variance see Heshmati (2001).

Output and inputs are chosen as per existing literature. The specific variables used in the analysis include the total quantity of labour hours used (h), output measured by cement dispatches, hourly labour real wages rates (w), fixed assets (q), age of the firm is represented by variables old(years since operation), public sector firm dummy, exporter dummy and a time trend representing exogenous rates of technical change (t).

Table 9.1: Descriptive Statistics

Variable	Scale	N	Mean	Std Dev	Minimum	Maximum
idnr		413	10.3	5.63	1	21
period		413	1998.98	7.38	1986	2011
lcost	(million)	413	132.75	88.23	7.27	482.61
hours		413	5127850	2963825	792000	18360000
q	(million)	413	0.73	0.86	0	6.55
w	(Rs.)	413	25.32	8.38	6.43	56.03
w1		413	0.2	0.47	0	8.39
k	(million)	413	2528.22	2896.5	14.38	15140.4
t		413	13.98	7.38	1	26
size		413	3.5	1.09	1	5
type		413	2.17	0.79	1	3
old		413	24.9	12.63	3	57

Nominal monetary values are converted into constant 2001 prices. The ‘wage’ variable is defined as hourly wages - an aggregate measure of the cost associated with the hiring of labour, including payroll taxes. The quasi-fixed variable, q (total fixed assets), is representative of production capacity constraint. Efficiency scores are also looked by different sizes of firms and by ownership structure. Size categories of the firm are determined based on the average number of full-time employees (see Table 9.2):

Table 9.2: Construction of 'Size' Variable

Number of Employees	Resultant 'Size' Classification
Employees ≤ 300	1-very small size firm
301 < Employees ≤ 500	2-small size firm
501 < Employees ≤ 700	3-medium size firm
701 < Employees ≤900	4-large size firm
Employees > 900	5-very large size firm

The regression outlined below was subsequently run on the population of cement companies. The results displayed in the tables contained within the subsequent section therefore display results that assume a common labour use efficiency frontier for all ownerships over pre and post privatization and deregulation period. A flexible translog functional form is used to approximate *f* (.) and g (.). The model can therefore be specified as follows:

$$\begin{aligned}
\ln h_{it} &= \alpha_0 + \alpha_y \ln y_{it} + \alpha_w \ln w_{it} + \alpha_q \ln q_{it} + \lambda_t + \lambda_i \\
&+ 1/2\left\{\alpha_{yy} \ln y_{it}^2 + \alpha_w \ln w_{it}^2 + \alpha_{qq} \ln q_{it}^2\right\} + \alpha_{yq} \ln y_{it} \ln q_{it} + \alpha_{wy} \ln w_{it} \ln y_{it} \\
&+ \alpha_{wq} \ln w_{it} \ln q_{it} + \alpha_{pub} PUB + \alpha_{age} \ln AGE + \alpha_{\exp} EXPORTER \\
&\left\{\beta_y y_{it} + \beta_w w_{it} + \beta_q q_{it} + \beta_t t + \beta_{pub} PUB + \beta_{age} \ln AGE + \beta_{\exp} EXPORTER\right\}\left[\mu_i + v_i\right]
\end{aligned} \tag{4}$$

where *h*, *y*, *w* and *q* are variables which are defined as above, *i* is an index of firms (i=1,2, . . . , *N*), *t* represents an index of time (t=1,2, . . . ,*T*). Finally, a vector of time and firm dummies representing the exogenous rate of technical change λ_t, and heterogeneity across firms represented by $\lambda_{I\ am}$ added in regression stages.

In order to facilitate the potential for the most efficient firm to change in each time period, time variant technical efficiency scores are calculated as per Schmidt and Sickles (1984), where

$$TINEFF_{it} = g(x_{it} : \beta)(\alpha_0 + \mu_i) - \min_t [g(x_{it}; \beta)(\alpha_0 + \mu_i)]$$
$$= \left(\beta y y_{it} + \beta_{wj} w_{jit} + \beta_{wl} w_{lit} + \beta_q q_{it} + \beta_t t + \beta_{pub} PUB + \beta_{age} \ln AGE + \beta_{\exp} EXPORTER\right)(\alpha_0 + \mu_i)$$
$$- \min_t \left[\left(\beta y y_{it} + \beta_{wj} w_{jit} + \beta_{wl} w_{lit} + \beta_q q_{it} + \beta_t t + \beta_{pub} PUB + \beta_{age} \ln AGE + \beta_{\exp} EXPORTER\right)(\alpha_0 + \mu_i)\right] \quad (5)$$

And technical efficiency is[38]:

$$TEFF_{it} = \exp(-TINEFF_{it}) \quad (6)$$

I expect α_y and α_q to be positive and α_w negative, which can be interpreted as the elasticity of labour demand with respect to output, quasi-fixed input and wages respectively. These expectations are only valid at the average point, with the corresponding elasticities (which are both firm specific and time specific) outlined below:

$$E_y = \partial \ln h_{it} / \partial \ln y_{it} = \alpha_y + 2\alpha_{yy} \ln y_{it} + \alpha_{yw} \ln w_{wit} + \alpha_{yq} \ln q_{it} \quad (7)$$

$$E_w = \partial \ln h_{it} / \partial \ln w_{wit} = \alpha_w + 2\alpha_{ww} \ln w_{it} + \alpha_{yw} \ln y_{it} + \alpha_{wq} \ln q_{it} \quad (8)$$

$$E_q = \partial \ln h_{it} / \partial \ln q_{it} = \alpha_q + 2\alpha_{qq} \ln q_{it} + \alpha y_{yq} \ln y_{it} + \alpha_{wq} \ln w_{it} \quad (9)$$

Time specific elasticity of labour with respect to time (the exogenous rate of technical change) is derived as:

$$E_t = \partial \ln h_{it} / \partial t = (\lambda_t - \lambda_{t-1}) \quad (10)$$

and return to scale is calculated as 1/Ey:

[38] For further detail on the estimation of efficiency and input-output variance see Heshmati (2001).

9.4. Estimation and Explanation

The model outlined in Equation (4) is firstly used to estimate labour demand function for cement firms. Table 9.3 shows estimates of the demand function, (f) and the variance function, (g). A majority of the firm specific variables are statistically significant and different from zero. The variance function, (g), outlined above, was estimated using the weighted non-linear least square method.

Table: 9.3: GLS Nonlinear Parameter Estimates of the Labour Demand Function and Estimates of the Variance Function

	Parameter Estimate	Approx Std Err	t Value	Approx Pr > |t|		Parameter Estimate	Approx Std Err	t Value	Approx Pr > |t|
a. labour demand function estimates									
a0	-1.163	0.434	-2.680	0.008	d2	0.715	0.223	3.210	0.001
ay	0.869	0.059	14.850	<.0001	d3	-0.495	0.190	-2.600	0.010
aw	0.583	0.098	5.960	<.0001	d4	-0.954	0.459	-2.080	0.038
aq	-0.336	0.050	-6.670	<.0001	d5	-0.450	0.142	-3.170	0.002
ayy	0.292	0.037	7.860	<.0001	d6	-0.084	0.156	-0.540	0.592
aww	0.262	0.104	2.520	0.012	d7	0.036	0.199	0.180	0.855
aqq	-0.071	0.023	-3.080	0.002	d8	-0.529	0.145	-3.650	0.000
ayw	-0.313	0.097	-3.220	0.001	d9	-0.267	0.147	-1.820	0.069
ayk	-0.152	0.041	-3.690	0.000	d10	0.071	0.212	0.340	0.736
awq	-0.069	0.072	-0.960	0.337	d11	-0.364	0.143	-2.540	0.012
Pub	0.156	0.067	2.340	0.020	d12	0.041	0.193	0.210	0.832
exp	-0.414	0.055	-7.510	<.0001	d13	-0.111	0.210	-0.530	0.599
ol	0.567	0.140	4.050	<.0001	d14	-0.303	0.205	-1.480	0.140
c2	0.173	0.075	2.310	0.021	d15	-0.745	0.206	-3.620	0.000
c3	-0.037	0.079	-0.460	0.644	d16	-0.118	0.243	-0.490	0.628
c4	-0.076	0.080	-0.950	0.345	d17	0.406	0.409	0.990	0.321
c5	-0.157	0.092	-1.700	0.089	d18	0.325	0.293	1.110	0.269
c6	-0.271	0.112	-2.430	0.016	d19	-0.124	0.217	-0.570	0.569
c7	-0.279	0.110	-2.540	0.011	d20	0.467	0.330	1.420	0.158
c8	-0.349	0.119	-2.940	0.004	d21	0.419	0.242	1.730	0.085
c9	-0.407	0.128	-3.190	0.002	b. variance function				
c10	-0.495	0.136	-3.640	0.000	by	0.073	0.013	5.720	.0001
c11	-0.429	0.147	-2.920	0.004	Bw	0.020	0.032	0.610	0.542
c12	-0.446	0.152	-2.940	0.004	bq	0.063	0.012	5.470	.0001
c13	-0.397	0.162	-2.460	0.014	bt	0.101	0.032	3.190	0.002
c14	-0.484	0.176	-2.760	0.006	bpub	0.178	0.037	4.880	.0001
c15	-0.492	0.179	-2.750	0.006	bexp	-0.013	0.040	-0.330	0.738
c16	-0.602	0.186	-3.240	0.001	bol	0.054	0.011	4.790	.0001
c17	-0.386	0.191	-2.020	0.044	σ_{2v}	8.1827			
c18	-0.440	0.195	-2.250	0.025					
c19	-0.621	0.212	-2.930	0.004					
c20	-0.684	0.214	-3.190	0.002					
c21	-0.532	0.222	-2.400	0.017					
c22	-0.382	0.223	-1.710	0.087					
c23	-0.575	0.231	-2.490	0.013					
c24	-0.550	0.241	-2.280	0.023					
c25	-0.616	0.239	-2.580	0.010					
c26	-0.735	0.263	-2.800	0.006					

9.4.1. Labour Demand Elasticities, Variances and Efficiencies

Firm and time specific elasticities of labour demand with respect to outputs, wages and quasi fixed input (fixed assets) were calculated and are presented in Table 9.4. The median values are reported by years, firm size and ownerships. At the median data point, all elasticities with the exception of wage and time elasticities are positive, indicating that there is a degree of responsiveness of labour demand to changes in the levels of output, wages and fixed assets. Labour demand elasticity with respect to the output is positive for all five sizes firms – namely very small, small, medium, large and very large and all three ownerships (public, private and privatized) firms. This is consistent as per expectation. This output elasticity is steadily increasing over time with a median elasticity of 0.32, suggesting that firms have not become less labour intensive over time.

One could conclude from this that this degree of elasticity is very unlikely to be significantly different across the number of firms included in the sample. This is a result that is to be expected, showing that a marginal change in the output will have the largest marginal effect on labour demand.

The wage elasticity is –0.180 (the largest of the input elasticities) with a relatively small standard deviation of 0.06. The elasticity of wages increased immediately after deregulation increasing from -0.068 in 1986 to –0.30 in 1995. The sign of this variable is consistent with theory, and the temporal pattern of change indicates that labour demand is becoming cyclical and less responsive to changes in the wage rate in the final two years of the sample. Reduction in the size of the labour may prove little difficult due to non availability of skilled labours in the years when demand for cement goes up with good economic progress or export potential. That has been the case in the last few years when companies exported a large quantity of cement to Afghanistan.

Table 9. 4: Median Input and Output Elasticities by Year, Size and Type of Ownership

	A: Labour demand elasticity				B: Marginal employment variance (risk) effects					
	Output	Labour	Fixed assets	Time	Output	Labour	Fixed assets	Time	TME	Efficiency
1986	0.465	-0.068	-0.024	0.000	0.018	0.466	-0.013	-0.101	0.471	0.881
1987	0.455	-0.079	-0.024	0.003	0.040	0.074	-0.033	-0.060	0.081	0.884
1988	0.507	-0.035	-0.023	-0.099	0.050	0.169	-0.065	0.045	0.154	0.885
1989	0.485	-0.080	-0.029	-0.050	0.049	0.193	-0.053	-0.007	0.189	0.880
1990	0.489	-0.097	-0.022	-0.061	0.019	0.006	-0.034	-0.017	-0.009	0.876
1991	0.497	-0.073	-0.027	-0.047	0.018	0.006	-0.067	-0.033	-0.043	0.878
1992	0.493	-0.125	-0.029	0.041	0.019	0.004	-0.052	-0.071	-0.029	0.936
1993	0.509	-0.142	-0.060	-0.065	0.053	-0.154	-0.068	-0.048	-0.169	0.937
1994	0.509	-0.189	-0.074	-0.051	0.152	-0.318	-0.065	-0.061	-0.231	0.939
1995	0.424	-0.306	-0.067	-0.079	0.050	-0.378	-0.055	-0.039	-0.383	0.932
1996	0.530	-0.287	-0.073	-0.005	0.156	-0.610	-0.095	-0.079	-0.549	0.928
1997	0.513	-0.121	-0.065	-0.155	0.054	0.294	-0.036	-0.015	0.312	0.933
1998	0.444	-0.124	-0.049	0.029	0.029	0.464	-0.013	-0.034	0.480	0.870
1999	0.442	-0.213	-0.040	0.022	0.019	0.066	-0.015	-0.037	0.070	0.861
2000	0.472	-0.162	-0.042	-0.103	0.016	-0.057	-0.009	-0.024	-0.050	0.871
2001	0.451	-0.140	-0.052	-0.074	0.002	0.029	-0.008	-0.024	0.023	0.837
2002	0.481	-0.209	-0.047	0.097	0.039	-0.284	-0.014	-0.058	-0.259	0.844
2003	0.522	-0.264	-0.075	-0.069	-0.001	-0.305	-0.009	-0.034	-0.315	0.834
2004	0.556	-0.307	-0.094	-0.094	0.004	-0.534	-0.003	-0.024	-0.533	0.833
2005	0.597	-0.213	-0.094	-0.071	0.050	-0.542	-0.006	-0.021	-0.498	0.838
2006	0.618	-0.268	-0.127	0.138	0.000	-0.805	-0.004	-0.073	-0.809	0.820
2007	0.656	-0.290	-0.141	0.035	-0.725	-1.309	-0.003	-0.042	-2.037	0.795
2008	0.689	-0.227	-0.141	-0.121	-0.547	-0.978	-0.002	0.008	-1.527	0.791
2009	0.620	-0.175	-0.133	0.041	-0.741	0.039	0.047	-0.010	-0.655	0.785
2010	0.619	-0.105	-0.116	-0.059	-0.533	0.084	-0.001	-0.002	-0.450	0.775
2011	0.656	-0.030	-0.115	0.027	-0.832	0.370	0.014	-0.007	-0.448	0.770
V small	0.187	0.035	0.071	-0.051	0.000	0.005	0.000	0.000	0.005	0.890
Small	0.512	-0.287	-0.064	-0.055	0.007	-0.090	-0.007	-0.011	-0.090	0.920
Medium	0.478	-0.196	-0.057	-0.050	0.015	0.023	-0.023	-0.033	0.015	0.832
Large	0.520	-0.201	-0.065	-0.051	0.044	-0.305	-0.036	-0.044	-0.297	0.916
V large	0.573	-0.103	-0.085	-0.051	-0.006	-0.356	-0.013	-0.026	-0.375	0.890
Public	0.491	-0.119	-0.036	-0.050	0.101	0.004	-0.072	-0.034	0.033	0.890
Privatized	0.520	-0.173	-0.066	-0.055	-0.001	-0.025	-0.012	-0.030	-0.038	0.911
private	0.504	-0.210	-0.070	-0.051	0.001	0.001	-0.006	-0.024	-0.004	0.831

The elasticity with respect to fixed assets has a median value of -0.06 with a relatively high standard deviation of 0.04. There is a trend in the elasticity starting at -0.024 in 1986 and ending at -0.115 in 2010-11, which indicates decreasing demand for labour with the expansion of capital. Negative sign is an indication of capital being a substitute to labour. More capital is indicative of modernization of production process which in turn would require less labour. These results support those of Heshmati (2001) – hence this study can conclude that there must be significant differences in the degree to which the crowding out of labour as a result of expansion of capacity coupled with new technology.

The sample median value of technical change (consisting only of a neutral component) changes only) over time is -0.05, indicating some positive technical progress (slight reduction in labour usage over time). Technical change fluctuates from positive to negative with negative trend established for many years at a time indicating consistent positive technical progress.

The magnitude of the different output elasticities also appear to vary with the size of the individual firm in question. Labour demand elasticity with respect to wages seems to increase as firm size increases. This illustrates that increased wage levels do not serve as great a deterrent to the hire of additional labour for larger firms as opposed to their smaller counterparts. The elasticity with respect to output does not decreases with size of firm, showing that larger firms are better able to expand their output without having the large effect on labour. Labour demand elasticity with respect to fixed assets seems to fall with the size of the firms in question (showing that expansion in capacity coupled with new technology requires less additional labour for larger firms). Finally, the time trend shows very consistent pattern of technical change for all sizes of firm, meaning that the some technical progress shown over the sample period has not been limited to firms of specific sizes.

In terms of elasticity differentiated by firm ownership, all ownership firms have the same labour demand elasticity with respect to output but significantly less than one. All this is expected by the fact that the firms have already quite significant payroll bills in their overall cost structure and further increase is likely to be responded in some reduction in employment in these firms.

The Employment Variance

The figures representing the following can be found in Table 9.3 (part b). The beta coefficient with respect to output is positive, and statistically significant at the 5% significance level. Of the input variables, the wage coefficient is positive but insignificant. The time trend is positive and statistically significant. The coefficient of fixed assets is positive and significant. The employment variance elasticity or marginal risk effects are calculated with respect to the dispersion factors of 'output', 'wages', 'fixed assets' and 'time trend', with median values being estimated separately for each year, firm size and ownership. These results, together with the overall sample median, are reported in Table 9.4 part b. Marginal variance (risk) effects evaluated at the median of the data with respect to 'output' is positive in both pre and post reforms period (except for last few years). Negative marginal effects are observed for wages for most of the years. In most of the cases standard deviations are large and, for some variables, are in excess of the median value itself. Thus, for firms with production levels close to the sample medians, the employment variance increases if the firm produces more output.

The variable ‘Wages’ is the most important factor contributing to the variance of employment in terms of marginal effects. The sign of marginal effect is as expected with lot of fluctuation. Significantly more variation in the estimated marginal effects seems to take place as firm size increases.

Technical Efficiency

The efficiency measured here is a relative efficiency score, as it is calculated relative to the firm demonstrating the ‘best-practice’ in each year where this individual firm is assumed to be 100% efficient. The median values of estimates of technical efficiency obtained from Equation (6) are reported in Table 9.4 part b by year, firm size and ownership. Technical efficiency is both firm and time-specific. The overall median technical efficiency is 87% with a standard deviation 5% meaning that, on average, firms could have reduced their labour usage by 13% without reduction in output. This is indicative of a relatively high level of median labour use efficiency displayed by firms over the sample period and similar to observed by Heshmati (2001) in the analysis of Swedish savings banks and extremely high as that observed in the Tunisian banking sector firms by Chaffai (1997).

However, what is apparent from investigating the changes in labour use efficiency over time is that the median technical efficiency over time is decreasing. In 1986, the average firm showed 88% labour use efficiency, compared with 77% in the final year of the sample period (10% reduction). The year on year change is largest between

1998 and 2011. Whether this was a phenomenon that was caused by the reforms is debatable, as efficiency levels seemed to decreasing continuously in the last decade of my sample period. What is apparent is that the deregulation reforms have discernibly adverse effect on labour use efficiency over time and could have translated into higher prices of cement produced during this period and firms would have suffered losses. Hence, there exists an appreciable gap between the best performing firms in the sample and those firms playing 'catch-up' (this is consistent with the results obtained by Bonaccorsi and Hardy (2005) with respect to the effect of regulatory reform upon the Pakistani banking sector). While this may be slightly disappointing, Ahluwalia (2002) suggests that a failure to live up to the full potential of reform might not be down to the changes in policies themselves, but a failure to implement these policy changes correctly. It may be that better implementation of the reforms policy will allow for the median firm in the sample to move closer to the efficiency frontier in the future.

There appears to be not a noticeable variation in technical efficiency between firms of different sizes with the exception of medium size firms. The results indicate that the largest firms could reduce their labour demand on average by around 9%, with the smaller firms only requiring around a 8% reduction at the median. Therefore, there is a very narrow gap between the optimal level of labour efficiency and that which is observed by the firms, which is in contrast to conclusion by Rao's (2005) study into efficiency of banking firms in the United Arab Emirates with different sizes.

Among firms of different ownership types, it is found that private firms are the relatively least efficient in terms of labour usage, followed by public firms respectively. Private firms could have reduced their labour usage by 17%, privatized and public by 9% and 11%, indicating that private firms were employing far more labour than is technically necessary given output levels, and still have some way to go in improving technical efficiency levels in the future.

The frequency distribution of technical efficiency is reported in Table 9.5 and Figures 9.1-9.8. A significant number of firms are found in the intervals of between 80% and 90% labour usage efficiency.

Table 9.5: Frequency Distribution of Efficiency Scores

eff	Freq.	Percent	Cum.
0.6	6	1.45	1.45
0.7	26	6.3	7.75
0.8	67	16.22	23.97
0.9	161	38.98	62.95
1	153	37.05	100
Total	413	100	

Chapter 9
Labour Use Efficiency

Figure 9.1 Industry Efficiency

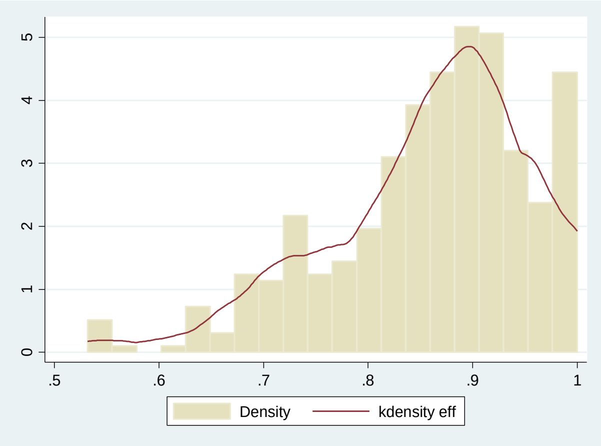


Figure 9.2: Public Firms Efficiency

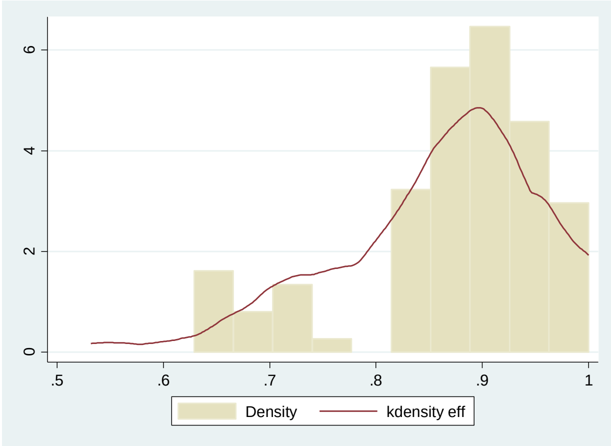


Figure 9.3: Privatized Firms Efficiency

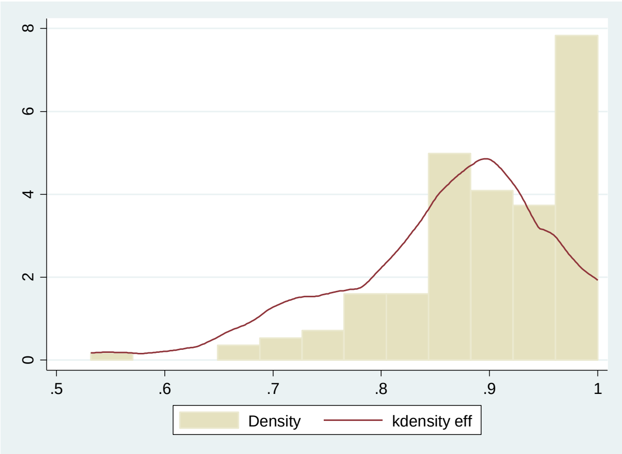


Figure 9.4: Private Firms Efficiency

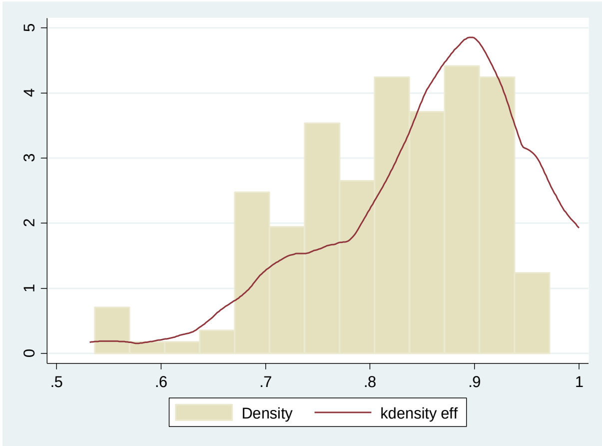


Figure 9.5: 1986 Efficiency

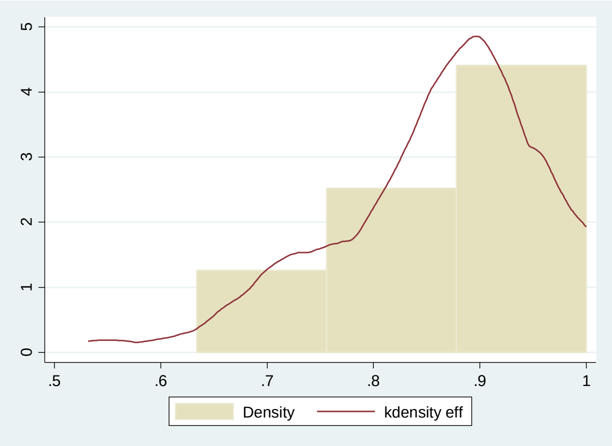


Figure 9.6: 1990 Efficiency

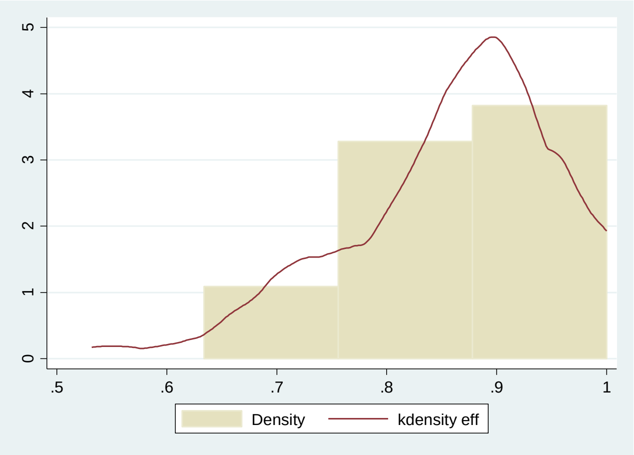


Figure 9.7: 1999 Efficiency

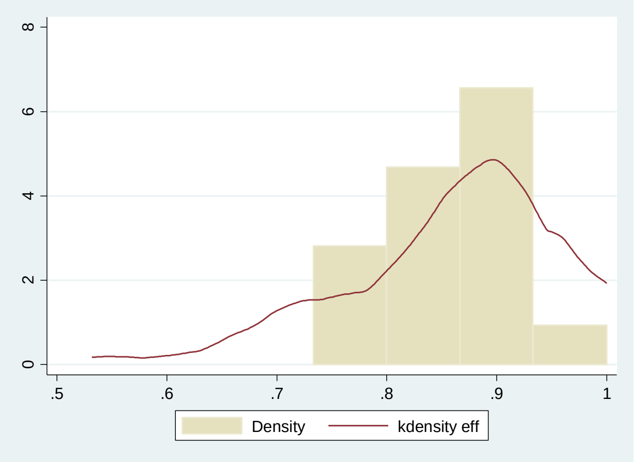
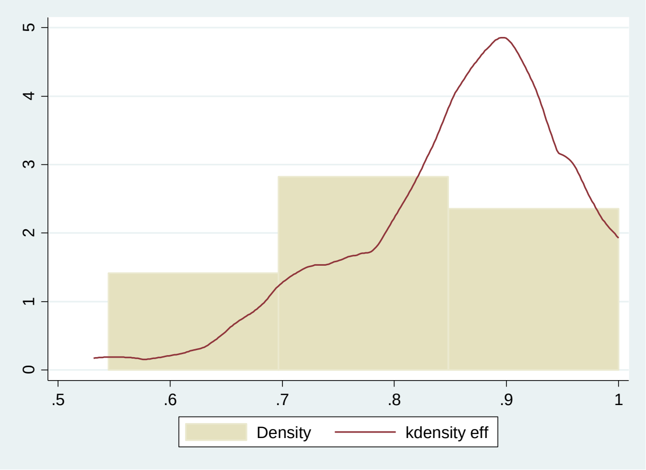


Figure 9.8: 2011 Efficiency



9.4.2. Elasticities and Efficiencies by Ownerships

Firm and time specific elasticities of labour demand with respect to outputs, wages and fixed assets and time are calculated and are presented in Table 9.6 by years, and ownerships. Some interesting observations could be made by looking at these results over time. Public sector firms before their eventual privatization become less labour intensive after reforms were introduced. Elasticity of output for public sector firms reduced from 0.479 in 1986 to 0.36 in 2003. This may partly due to less variation in elasticities after firms eventually being privatized gradually over this period (Associate in 1996, Mustehkam in 2009 and Javeden in 2003). Contrary to public sector firm's output elasticities for privatized firms increased from 0.58 in 1992 to 0.667 in 2011. Deregulations had not had any significant effect on employment response nonetheless. This partly is due to non-availability of skilled labour. Rather than shedding more employees, management opted to keep these employees on the payroll and use them when economic conditions improve and the demand for cement go up.

When it comes to labour adjustment in response to wages, elasticities pattern over time reveals some interesting trends. Immediately after deregulations, firms responded in accordance to prediction and wages elasticity kept rising until 1997. But then, afterward came down for privatized as well as private sector firms. By 1998, firms would have made appropriate adjustment in their labour use and shedding further workers would have been damaging to long term competitiveness of the firm. When it comes to technological progress, firms experienced a modest progress during the post reform period irrespective of ownerships. Similar to previous discussion, one could also conclude that labour use efficiency was on the downward slope in the last few years of the sample irrespective of the nature of ownerships. Decline in efficiency in later years is in the region of 4-5%. Again that might be explained by decrease in economic activity alongside some other factors.

Table 9.6: Median Input and Output Elasticities and Efficiency by Year, Size and Type of Ownerships

	Output			Labour			Fixed Assets			Time			Efficiency		
	public	privatized	private	public	privatized	private	public	privatized	private	public	privatized	private	public	privatized	private
1986	0.479		0.310	-0.058		-0.191	-0.024		0.022	0.000		0.000	0.881		0.893
1987	0.486		0.424	-0.103		-0.055	-0.028		-0.020	0.003		0.003	0.889		0.868
1988	0.513		0.501	-0.060		0.038	-0.025		-0.015	-0.099		-0.099	0.890		0.872
1989	0.514		0.443	-0.138		0.014	-0.038		-0.017	-0.050		-0.050	0.887		0.875
1990	0.499		0.399	-0.097		-0.096	-0.022		-0.024	-0.061		-0.061	0.885		0.861
1991	0.512		0.382	-0.149		0.012	-0.042		-0.017	-0.047		-0.047	0.887		0.861
1992	0.449	0.584	0.366	-0.115	-0.125	0.074	-0.036	-0.077	-0.001	0.041	0.041	0.041	0.913	0.950	0.926
1993	0.505	0.573	0.415	-0.138	-0.272	-0.033	-0.049	-0.090	-0.031	-0.065	-0.065	-0.065	0.910	0.960	0.925
1994	0.525	0.564	0.410	-0.274	-0.146	-0.129	-0.059	-0.085	-0.026	-0.051	-0.051	-0.051	0.909	0.960	0.930
1995	0.417	0.549	0.351	-0.342	-0.203	-0.294	-0.084	-0.068	-0.041	-0.079	-0.079	-0.079	0.927	0.945	0.911
1996	0.546	0.566	0.503	-0.413	-0.256	-0.102	-0.062	-0.079	-0.077	-0.005	-0.005	-0.005	0.925	0.956	0.886
1997	0.573	0.438	0.468	-0.331	-0.103	-0.095	-0.080	-0.023	-0.074	-0.155	-0.155	-0.155	0.933	0.963	0.890
1998	0.505	0.444	0.432	-0.216	-0.147	-0.107	-0.037	-0.028	-0.052	0.029	0.029	0.029	0.875	0.910	0.839
1999	0.440	0.443	0.420	-0.181	-0.333	-0.105	-0.009	-0.031	-0.049	0.022	0.022	0.022	0.862	0.898	0.829
2000	0.462	0.472	0.456	-0.050	-0.186	-0.134	0.001	-0.034	-0.051	-0.103	-0.103	-0.103	0.864	0.920	0.832
2001	0.409	0.512	0.470	-0.067	-0.280	-0.108	0.022	-0.082	-0.060	-0.074	-0.074	-0.074	0.866	0.896	0.826
2002	0.420	0.485	0.485	-0.046	-0.189	-0.303	0.021	-0.035	-0.067	0.097	0.097	0.097	0.866	0.902	0.831
2003	0.361	0.533	0.569	-0.120	-0.203	-0.280	0.038	-0.055	-0.096	-0.069	-0.069	-0.069	0.864	0.896	0.819
2004		0.597	0.534		-0.211	-0.374		-0.074	-0.103		-0.094	-0.094		0.897	0.813
2005		0.604	0.579		-0.152	-0.232		-0.068	-0.104		-0.071	-0.071		0.895	0.807
2006		0.607	0.618		-0.100	-0.358		-0.053	-0.148		0.138	0.138		0.871	0.789
2007		0.534	0.688		-0.274	-0.366		-0.062	-0.143		0.035	0.035		0.856	0.741
2008		0.521	0.695		-0.043	-0.301		-0.033	-0.157		-0.121	-0.121		0.819	0.745
2009		0.485	0.637		-0.076	-0.267		-0.057	-0.144		0.041	0.041		0.848	0.727
2010		0.468	0.636		-0.001	-0.141		-0.064	-0.132		-0.059	-0.059		0.838	0.720
2011		0.667	0.656		0.044	-0.081		-0.121	-0.115		0.027	0.027		0.884	0.716
1986-91	0.506		0.412	-0.100		-0.022	-0.027		-0.017	-0.049		-0.049	0.887		0.870
1992-11	0.456	0.534	0.494	-0.160	-0.169	-0.138	-0.037	-0.063	-0.076	-0.058	-0.055	-0.055	0.892	0.898	0.828
1992-96	0.505	0.566	0.410	-0.274	-0.203	-0.102	-0.059	-0.079	-0.031	-0.051	-0.051	-0.051	0.913	0.956	0.925
1997-2007	0.440	0.512	0.485	-0.120	-0.189	-0.232	0.001	-0.053	-0.074	-0.069	-0.069	-0.069	0.866	0.897	0.826
2007-2011		0.521	0.656		-0.043	-0.267		-0.062	-0.143		0.027	0.027		0.848	0.727

9.4.3. Determinants of Labour Use Efficiency

In order to complete a more detailed analysis of the results, a second stage panel data random effect regression was run in order to model a variety of other factors against the firm specific efficiency scores obtained in the previous sections. Five different model specifications (which I name model1-model5) are estimated in order to check for robustness in the results with each involving the inclusion and exclusion of certain model variables. Time dummies are added to see the effect of deregulation and privatization on labour use efficiency in pre and post deregulation/privatization periods. The output from these regressions can be seen in Table 9.7. The sign and significance of the model variables do not seem to change dramatically between the 5 models specifications, indicating that the model parameters are consistent and robust.

In this exercise I proxies my firm size with log of total assets that could accommodate capacity addition in post deregulation period as well as addresses smart dry production technology which could potentially reduce labour requirements. Assets is a variable that has a positive and statistically significant coefficient (generally), indicating that firms with larger assets (hence production capacity) tend to be more efficient in their use of labour. This result is an indication of potential scale economies and needed to be explored further. The variable reflecting ownership change from public to privatized is to be consistent with the other studies conclusions indicating an improvement after change of ownership (contrary to public sector firms who experienced a decline in their labour use efficiency compare to firm operating in private sector)

Firms spending more money on admin and marketing campaign tend to be less efficient in labour use. Having access to higher working capital does not appear to have any notable effect on labour use efficiency. Financially profitable as well as productive firms (indicated by return on assets (roa) and total factor productivity variables) were on the average using labour more efficiently.

Operating in north region and using dry process technology appears to have negative effect on labour use efficiency. Time dummies show decreased levels of labour use efficiency in post deregulation period for the 2002 onward, which supports the contention that the reforms enacted in the 1990s had some positive effect initially, but for the last few years, trend has reversed and reforms had not encouraged firms to use labour more efficiently lately.

Table 9.7: Random Effect Regression Results: Dep. Variable: Efficiency Scores

Variable	model1	model2	model3	model4	model5
lassets	0.01787***		0.02010***	0.01613***	0.01098**
oexptc	-0.40008***		-0.41701***	-0.40884***	-0.53108***
roa	0.08841*	0.13890***	0.12085***	0.08208*	0.07719*
tfp	0.01902*	0.02810**		0.01346	0.01187
wcr	0.0063	0.00428		0.00618	0.00274
dry	-0.05904***	-0.07343***	-0.05672***		-0.07380***
north	-0.06095***		-0.05867***	-0.06837***	
exporter	-0.0141		-0.01437		-0.00279
public	0.00245	-0.02546	0.00146	-0.05353***	-0.03273*
privatized	0.05979***	0.04462***	0.05872***	0.09741***	0.03168**
Yearly dummies					
1987	0.03663	0.02167	0.04636	0.03971	0.04331
1988	0.04093	0.02978	0.04843*	0.043	0.04663
1989	0.04487	0.03685	0.05385*	0.04651	0.0502
1990	0.04388	0.03923	0.05179*	0.04346	0.05061*
1991	0.04302	0.04518	0.05166*	0.04299	0.05024*
1992	0.06589**	0.06233*	0.07552**	0.07427**	0.07345**
1993	0.05340*	0.04671	0.06486**	0.06394**	0.06580**
1994	0.05678*	0.04891	0.06710**	0.06620**	0.06985**
1995	0.04841*	0.03532	0.06137**	0.05885*	0.06162*
1996	0.05984*	0.06873**	0.07350***	0.06922**	0.07373**
1997	0.06770**	0.08210**	0.08074***	0.07734**	0.07696**
1998	0.00845	0.02481	0.01797	0.02114	0.01498
1999	0.00325	0.01976	0.01335	0.01422	0.00947
2000	0.0125	0.02721	0.01877	0.01949	0.01758
2001	0.00551	0.02644	0.01093	0.0133	0.0123
2002	-0.00171	0.00939	0.00815	0.00379	0.00632
2003	-0.0064	0.00363	0.00166	-0.00157	-0.00055
2004	-0.01588	-0.00516	-0.00796	-0.01284	-0.00887
2005	-0.03196	-0.01358	-0.02598	-0.02722	-0.0195
2006	-0.05891**	-0.03911	-0.05184*	-0.05467*	-0.04561
2007	-0.06488**	-0.04065	-0.06643**	-0.06425**	-0.05797*
2008	-0.0443	-0.02967	-0.05021*	-0.04868*	-0.03767
2009	-0.05638*	-0.04534	-0.05897**	-0.05646*	-0.04754*
2010	-0.04411	-0.03316	-0.05200*	-0.0461	-0.03626
constant	0.76166***	0.82020***	0.77447***	0.72210***	0.80910***

Notes:
lassets= log(assets); oexptc= general and administrated expenses/total expenses; roa= return on assets; tfp= total factor productivity; wcr= working capital ratio; dry = production process dry; north=region north ; exporter= firm is exporter ; public= ownership is public; privatized= ownership status privatized.

9.5. Conclusion

This chapter has sought to examine the efficiency of labour use in the cement industry during a period of significant reform using data from 21 cement firms analysed over the period between 1986 and 2011. A flexible translog functional form is used where demand for labour is a function of wages, a quasi-fixed input (in the form of capacity) and a time trend. Of those inputs, labour demand elasticities are as expected, with the largest elasticity being observed with respect to wages. Of output, positive labour demand is observed.

The most interesting conclusions from this study are those that illustrate technical efficiency levels, and the way in which these efficiency levels have changed over time. It was found that, on average, firms could have reduced their labour usage by 13% with output remaining constant. However, industry was generally experiencing decrease in labour use efficiency across the deregulation years of the study and in particular during 1999 to 2011, indicating that policies enacted in the 1990s to assist firms in the reduction of their labour use at least had a neutral effect or at best were reasonably not successful. This level of efficiency does not vary with firm size too. Among firms of different ownership types, it was found that private firms were the least efficient in terms of labour usage, followed by public and privatized firms respectively.

It would appear that the significant deregulation reforms of the last 2 decade in economy helped some industries such as banking firms to some extent to reduce the degree of over-usage of labour but I am unable to say the same in case of cement industry. There exists, however, a fairly small degree of inefficiency in terms of labour usage, particularly among the very those firms who were privatized in 1991/92. It may be deemed that additional effort needs to be made to streamline these firms if the desired labour use efficiency gains are to be made.

CHAPTER 10

Reforms and Competition in the Cement Industry

This chapter builds on existing literature by looking into level of competition in the cement industry during pre- and post privatization period by using a longer sample period (26 years). In my effort to test the allegations that producers association has formed a cartel, I use some widely used traditional competition indices alongside new indices of competition. These methods include simple indices such herfindhal index (H), top 3 firms market share measured by concentration index (C_3), and firms mark-up over marginal cost measured by price-cost margin (PCM). Regression based methods include estimation of competition index (λ), lerner index (LI) and Boone β. Subsequently, I link firms pricing decisions to their marginal and average costs (MC, AC) and net returns on assets/ investment (ROA).

10.1. Introduction

Microeconomic theory postulate two extremes of environment in which firms operate namely perfect competition and monopoly. Perfect competition is normally considered the case for most of the empirical case studies unless there is strong case of otherwise. Under this environment, firms are price takers as an infinite number of firms operate without colluding in setting prices or output quantities. Hence, an infinitely large number of firms set price equal to marginal cost at the lowest level of long-run average cost. By doing so, they could make some profit in the short term, but unable to do so in the long run. Hence, survival of the firms is dependent on operating at least at the minimum efficient scale. All those firms not able to do so would leave the industry in the long run. Hence, it becomes the case of survival of the fittest.

Pure monopoly condition is opposite whereby firm is no more price taker and could make long term sustainable profit by setting price above of its marginal cost. Hence, if number of firms is not large enough, firms would have incentive to collude and keep earning economic profit, unless conditions change such as new firms entry or change in status quo through government policy such as deregulation and privatisation.

There had been a significant effort in empirical industrial economics area to test these two extremes of the competitions using different industries data in developing as well as developed countries in response to change in regulatory policy and/or transfer of ownership as well as to investigate the claim of monopoly formation in different countries. One of the early studies is by Douglas and Miller for the US airlines industry as early as 1974. Lately, some authors tested the competition such as those by Cowan (1997), Oral and Mistikoglu (2005) and Ferarri and Guilietti (2005) for different industries including utilities (UK water industry), the Turkish brick industry and the Italian electricity industry respectively.

The potential of forming a cartel in the cement manufacturing is high due to implicit entry barrier (partly due to high level of sunk cost i.e. in the form of initial investment of setting up plants and proximity to raw material such as limestone, clay and gypsum etc.), and thus cement industries across the world have found themselves subjected to a particularly high level of research interest [some of such studies carried out to find market power in this case include: Zeidan and Resende (2009) and Salvo (2010) for Brazil; Hu¨schelrath and Veith for Germany; Rosenbaum and Sukharomana (2001) for USA; Çelen and Gunalp (2010) for Turkey; Bejger (2012) for India; Steen and Sørgard (1999) for Norway; and Bejger (2011) for Poland].

In term of choice of methods to assess competition levels, there appears to be significant variations. Some studies in this regards have used Rosse-Panzar 'H' statistic as the preferred methodology (examples of such studies include study by Molyneux *et al.* (1996) who assess levels of competition within the Japanese banking sector, cross country comparison by Bikker and Haaf (2002), and an examination of the Italian banking industry by Coccorese (2004)). Rosse-Panzar 'H' statistic has been preferred methodology in examining competitive conditions of the banking industries due to relatively ease of estimation and comparatively less data requirements.

Some authors used more advance methods such as the structural model of competition and conjectural variations. Shaffer (1993), for example, looked to assess the levels of competition in the Canadian banking industry by measuring the relationship between marginal revenues and cost subject to a given level of output of the banks. Since then, lot of studies used this methodology to estimate the levels of competition in banking as well as non banking industries Shaffer alongside other authors estimated cost estimation to detect some interesting situations such as the presence of 'super-competition', referring to a situation in which firms produce more compare to competitive level and where marginal cost exceeds marginal revenue presumably to capture some market power in the future or to fully utilize excess capacity. Empirically, Gruben and McComb (2003) observed this situation in the Mexican banking industry after the privatization and other regulatory reforms were introduced.

The underlying benefit of reforms alongside other advantages is the belief that these would supposedly lead to lower prices for consumers and greater levels of efficiency for the firms and thus make market structures more competitive. This chapter aims to establish whether or not the privatization and deregulation policy adopted by the government has made industry more competitive, through the estimation of competition indices by parametric as well as non-parametric methods.

In the next sections, the study will review state of play in the Pakistani cement industry and then discuss the relevant work in the area of privatization/deregulation and its effect on competition. Subsequent sections then present the theoretical underpinnings and methodology. Data sources and relevant variables are explained and empirical analysis part deals with estimation of different models. Finally, last section concludes the discussion.

10.2. Competition in the Pakistani Cement Industry

In common with many other industries, the cement industry in Pakistan has traditionally been subjected to heavy government intervention through nationalisation in 1970s and price setting by the state regulatory authority [State Cement Corporation of Pakistan (SCCP)], with a majority of firms operating under public ownership (only 2 out of 14 during 1986-90 were privately owned). From the early 1990s, this composition began to reverse, with a series of reforms including privatization, deregulation coupled with incentives to private sector to set up cement manufacturing facilities. As a result of these reforms, there was a significant transfer of ownership from the public to the private sector in early 1990s, with individual firms being able to greater levels of control over the way in which they operate (for example, after the reforms, firms have had significantly greater control over setting capacity requirements and price). Alongside introducing aggressive marketing campaign and a streamlining of manpower, it is hoped that the long-term effects of these changes would be to increase the level of competition in the cement sector.

After the reforms of early 1990s, there had been significant shift in the way now firms operate and set prices as per market conditions. Industry has added a significant capacity in post reforms period. North region has seen a significant number of new firms entering the industry. Industry has also witnessed some mergers and acquisitions. Small size less profitable companies are being bought by larger players. Since 2003, the industry has also started exporting cement to neighbouring countries such as India, Afghanistan, Iran and UAE. Proponents of reforms and free market feel that industry has become very competitive over time and consumer are getting benefit through enhanced consumer surplus and availability of product round the year compare to those days when industry was predominantly operating under government ownership.

However, there had been serious allegations of collusions and monopoly forming tactics as a result of establishment of a producer association called 'All Pakistan Cement Manufacturing Association' (APCMA). APCMA offices had been raided twice by the federal Investigative Agency (FIA) in the last few years to collect documentary evidence of any written agreements between producers in regard to prices or production quota. Monopoly Control Authority (now Competition Commission of Pakistan) carried out a detailed assessment of the industry to investigate collusion practices and concluded that commission was unable to prove that industry was operating under any sort of cartel or producers were colluding in setting prices or productions quotas. One such report in 2008 concluded:

Cartel or Not?

"At this point-in-time the Commission has not noted sufficient evidence to suggest there being one. The cartel question hence, remains an open one. After analysing industry fundamentals the opinion of the commission is that the current price hike in cement could be the result of change in sector fundamentals affecting the demand and supply dynamics and due to commercial reasons. Nevertheless, the Commission cannot completely rule out the possibility that this across the board simultaneous price increase may have arisen from collusive behaviour of the incumbent cement producers"

Although no documentary proof has been found by regulatory authorities but by looking at the concentrations ratios (see Table 10.1) one could feel that 40% of capacity is owned only by top 3 firms and remaining 60% is shared among other firms. However, even worse, this ratio is almost 50:50 for total assets.

Table 10.1: Concentration Ratios for the Top 3 Firms

(based on total assets and rated production capacity)

	Assets	Capacity
Years	CR3	CR3
1987	0.33	0.38
1990	0.36	0.36
1997	0.42	0.34
2003	0.42	0.33
2008	0.47	0.44
2011	0.48	0.41

Source: own calculation

10.3. Deregulation and Competition- Review of Literature

A number of studies have found that changes in the way which certain industries are operated can have a positive effect upon financial and operational performance. Some early studies supported the positive impact of reforms i.e. Thompson, 1987, Vickers and Yarrow, 1988, Bishop and Kay, 1989, Boardman and Vining, 1989, Megginson, Nash and van Randenburgh, 1994, Galal *et al.*, 1994, Boycko *et al.*, 1995, Martin and Parker, 1995, Newbery and Pollitt, 1997, Shliefer, 1998, Boubakri and Cosset, 1998, and D'Souza and Megginson, 1999. Since 2000, authors such as Shirley and Walsh (2000), Saal and Parker (2000), Megginson and Netter (2001), Rossi (2001), Chirwa (2001), Dewenter and Malatesta (2001), D'Souza *et al.* (2002), Jones and Mygind (2002), Estache *et al*. (2002), Djankov and Murrell (2002), Wei and Varela (2003), Sun and Tong (2003), Cullinane and Song (2003), Li and Xu (2004), Chirwa (2004), Brown *et al.* (2006), Okten (2006), and Amess and Roberts (2007) also concluded that firms under private management performed better. The literature however, does not provide a clear indication of the extent to which reforms will enhance competition. Some of the studies relevant to the financial sector including the banking industry are summarised below.

Yildirim and Mohanty (2010) investigated the effect of deregulation on the state-level competition in U.S. banking markets over the period 1976-2005. The study results confirm that the U.S. banks in general operated under monopolistic competition during the period examined. The study concluded that the U.S. banking industry have become less competitive due to rising market power of large size banks as a result of geographic deregulation.

Ho (2010) looked at the ease of regulation effect on the banking industry in Hong Kong. Overall, the author found the positive role of deregulation whereby the industry has become more competitive and the consumers are better-off after the deregulation.

Empirical results also confirm the fact that the banking sector is operating under non-cooperative competitive behaviour.

Maudos and Solís (2011) looked at the role of deregulation in determining competition in the Mexican banking industry in the period 1993–2005. The empirical evidence pointed towards existence of monopolistic competition. The lerner index showed an increase in competition in loan market but decrease in the deposit market in post reforms period. Thus the study questioned the effectiveness of new regulatory regime when it comes to competition in the industry.

Cetin and Benk (2011) evaluated the post deregulation effect on the competition in the Turkish airline industry. The study documented positive effect of policy on the competition that has started benefiting customers.

Okoeguale (2012) studied 1996 deregulation policy on the US telecommunication industry. The author was able to find that deregulation increased merger activity by increasing competition. The authors concluded that “Deregulation opened both the local and long-distance telecom markets to competition from new communication technologies, resulting in a significant increase in IPO and merger activity”.

Studies examining the level of competition in Pakistan have not been forthcoming. Most of the studies conducted so far are limited to financial sector such as banking industry. One of such study is by Khan (1998) which concluded an increase in the competition levels as a result of reforms introduced in early 1990s. The study also noted that competition is on the rise, but still limited. In a study of cross country within the sub-continent, Perera *et al.* (2006) show that banking profits are earned under conditions of monopolistic competition. This study also looked into nature of banking business and concluded that in the case of Pakistani banking industry, fee earning business is more competitive, while for Indian banking interest earned on the traditional banking such as deposit taking and loan making is more competitive.

This chapter builds on this existing literature by looking into level of competition in the cement industry during pre- and post privatization period by using a much longer sample period (26 years) than a majority of past studies. In my effort to evaluate the development of competition and test the allegations that producers association has formed a cartel, I use some widely used traditional competition indices alongside new indices of competition. These include traditional non-parametric methods such as herfindhal index (H), top 3 firms market share measured by concentration index (C3), and firms mark-up over marginal cost measured by price-cost margin (PCM). Parametric measures include estimation of competition index (λ), lerner index (LI) and Boone β. Subsequently, I relate firms pricing decisions to marginal and average costs (MC, AC) and net returns on assets/ investment (ROA).

10.3. Methodology

There are a number of competing approaches to the assessment of competitive conditions. I use a series of different methodologies including simple ratios (non-parametric) and more advanced regression to observe the level of competition in the industry. The calculation of non-parametric indices is simple and is well documented and therefore do not needed to be explained in greater detail here but in the following, I discuss parametric methods and subsequently use these methods on the cement industry.

10.3.1 Estimation of Competition Index (λ) by Demand and Supply

I follow the methodology of Shaffer (1993), which will briefly be outlined below. Assuming that the goal of a firm is to maximise profit, I will also assume that firms objective is to meet the profit maximising condition, where marginal revenue equals marginal cost. Under conditions of perfect competition, the firm's marginal revenue would be equal to its average revenue, or price. Hence, the firm would continue to increase production until their marginal cost was equal to the output price. Under conditions of relative imperfection, where the firm's own actions have some effect upon the market price, marginal revenue is divergent from price. In accordance with Bresnahan (1982), the firm's demand function can be written as $Q = D(P, Y, \alpha) + \varepsilon$ and true marginal revenue function with semi elasticity of demand is MR= P+

$h(Q,Y,\alpha) = P+Q/(\Delta Q/\Delta P)$, where P is the product price, Q is the aggregate output, Y is a vector of exogenous variables and α is a vector of estimated demand parameters.

However, the firm's perceived marginal revenue function is $MR^{p}= P+\lambda h(Q,Y,\alpha)$, where $0 \le \lambda \le 1$ is new parameter that could be estimated and represents distinction between demand and marginal revenue. The λ term is included to represent the degree to which individual firms are aware of the divergence of average revenue (or price) from marginal revenue. If I assume $c(Q, W, \beta)$ firms' marginal cost function then profit maximising firm is likely to set perceived marginal revenue equal to marginal cost such as: $P = c(Q,W,\beta) -\lambda h(Q,Y, \alpha) + \eta$. When λ is zero, firms behaves as if the two are identical (hence indicating that the firm at least believes that it is perfectly competitive, and therefore sets price equal to marginal cost). When λ is equal to one, it indicates a perfect understanding of the separation of price from marginal revenue, and is indicative of monopolist behaviour, or a collusive oligopolies. The closeness of the actual value of λ to either of these two competitive extremes indicates the relative extent to which firms believe themselves to be operating in different competitive conditions. In that way λ can be seen as an index of market power.

Elementary economic theory also suggests that industry output will be lower and price higher under conditions of monopoly, as compared to the perfectly competitive alternative. The extent to which, industry price and output deviates from conditions of perfect competition can be approximated by the inverse of the λ value. Market price deviates from competitive price by $-\lambda Q/(\Delta Q/\Delta P)$, while the deviation in quantity is determined by dividing the competitive output by $\Delta Q/\Delta P$, multiplied by the deviation in price.

The key to the methodology, therefore, is the accurate calculation of λ. The first step in the calculation of this term is a demand function representative of the true demand curve. I approximate my demand function as:

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 PZ + \alpha_4 Z + \alpha_5 PY + \alpha_6 YZ + e \qquad (1)$$

Where Q is the quantity of outputs (quantity of cement produced and sold), P is the respective price of cement sold per ton (total sales divided by total quantity sold), Y is approximated by demand enhancing economic activity (development expenditure as a % of GDP), Z is proxy for substitute of cement (due to the fact that there is no perfect substitute of cement, I use construction activity) and e is the residual or error term. I had a choice of using either GDP growth rate or the development expenditure indicators. But based on the fact that a significant portion of demand for cement is determined by the government spending on the roads, buildings and defence housing and infrastructure, I use this proxy. Based on different government priorities in the past, higher level of GDP growth could not lead to higher demand for cement. But higher level of development would almost lead to higher demand for cement. The multiplicative terms PZ, PY and YZ are included to estimate λ through the rotation of the demand curve.

The second stage in the estimation of λ is a marginal cost function obtained through a translog cost function as follows:

$$LnC = \beta_0 + \beta_1 \ln Q + \beta_2 (\ln Q)^2 + \beta_3 \ln W1 + \beta_4 \ln W2 + \beta_5 \ln W3 + + \beta_6 \ln W4 + 0.5*\beta_7 \ln (W1)^2 + 0.5*\beta_8 \ln(W2)^2 + 0.5*\beta_9 \ln(W3)^2 + 0.5*\beta_{10} \ln(W4)^2 + \beta_{11} \ln W1 \ln W2 + \beta_{12} \ln W1 \ln W3 + \beta_{13} \ln W1 \ln W4 + \beta_{14} \ln W2 \ln W3 + \beta_{15} \ln W2 \ln W4 + \beta_{16} \ln W3 \ln W4 + \beta_{17} \ln Q \ln W1 + \beta_{18} \ln Q \ln W2 + \beta_{19} \ln Q \ln W3 + \beta_{20} \ln Q \ln W4 + e \qquad (2)$$

LnC in the above represents log of total cost (including production, distribution and admin etc.), while $\ln W_1$, $\ln W_2$, $\ln W_3$, $\ln W_4$ are exogenous input prices (log of yearly employees wage rates, price of furnace oil, price of electricity, bag and price of limestone per ton). Fifth input price (price of bag) is used to impose homogeneity in input prices. The implied marginal cost function is therefore as follows:

$$MC = [C/Q] [b_1 + b_2 \ln Q + b_3 \ln W1 + b_4 \ln W2 + b_5 \ln W3 + b_6 \ln W4] \qquad (3)$$

With these two equations in place (1 & 3), the calculation of λ can be attempted. The supply relation is estimated from above equation, assuming a degree of market power (and hence influence over price) as well as profit maximisation on the part of the firms concerned.

$$P = -\lambda Q / [a_1 + a_3 Z + a_5 Y] + [C/Q] [b_1 + b_2 \ln Q + b_3 \ln W1 + b_4 \ln W2 + b_5 \ln W3 + b_6 \ln W4] - b_7 DQ / [a_1 + a_3 Z + a_5 Y] + \mu \qquad (4)$$

Where μ represents the error or residual term, while D a dummy variable to represent post reforms period (dummy variable =1 for the post deregulation period 1990 onward). λ is calculated from the above equation, representing a measure of market power, where the value for firms operating under conditions of monopoly or collusive oligopoly should be higher than that of more competitive market conditions.

10.3.2 Estimation of Lerner Index: Conjectural Variation (CV)

In this regard, I follow the methodology developed by Iwata (1974) in which the parameters from a firm's behavioural equation are estimated. The methodology assumes that all firms seek to maximise profits and determine market prices and the levels of output based on the costs and the degree of competition. Let say q_j represents the output of firm j, $j = 1, 2, \ldots m$ and $\sum_j q_j$ = Q (the output for the entire industry). The inverse demand function is specified as $p = p(\mathcal{Q}, \mathcal{Z})$, where $\mathcal{Z}$ is a vector of exogenous variables that have some effect upon demand. In addition, let $C_j = C(q_j, \omega_j)$ be the cost function for firm j, where ω_j is the vector of the prices of inputs employed by firm j. Firms therefore try to maximise profit levels by solving the following equation:

$$\max_{qj} \Pi_j = p(\mathcal{Q}, \mathcal{Z}) - C(q_j \omega_j) \qquad (5)$$

Where, the first order condition which corresponds to the above is given as:

$$p_j = C'(q_j \omega_j) - \frac{\theta_j}{\tilde{\varepsilon}} \qquad (6)$$

This first order condition can be decomposed into two separate parts. The first corresponds to the cost element of equation (5) and the second is intended to measure the degree to which the market deviates from perfect competition. Conjectural elasticity (θ_j) of total industry output with respect to the output of the j[th] firm is defined as:

$$\theta_j = \frac{\delta Q/\delta q_j}{Q/q_j}\,, \qquad (7)$$

where $\tilde{\varepsilon}$ is the market demand semi-elasticity such as:

$$\tilde{\varepsilon} = \frac{\delta Q/\delta p}{Q}, \tilde{\varepsilon} > 0 \qquad (8)$$

As the objective is to estimate the overall degree of market power within the industry, the estimation of the ratio $\lambda \equiv -\theta_j/\tilde{\varepsilon}$ is sufficient in order to calculate the learner index.

Dividing lambda by the average price in the industry, I get lerner index *(LI)* $\equiv \lambda/p$, LI $\in [0, 1]$ measuring the relative mark-up of price over marginal cost (Appelbaum, 1982). Equation (6) is estimated simultaneously alongside a total cost function where as mentioned above, the production technology is assumed to be based on five inputs and their prices (labour, furnace oil, electricity, limestone and paper bag). I also include time dummies in the cost function to capture the economic cycles and time effects. To preserve the degrees of freedom, I use twelve time dummies, each one covering two years while, treating the years 1986 and 1987, base category. The translog specification for such a cost function, would take the form:

$$\ln(TC_j)$$
$$= c_0 + s_0 lnq_j + 0.5 * s_1(lnq_j)^2 + \sum_{i=1}^{4} c_i(lnw_{ij}) + lnq_j \sum_{i=1}^{4} s_{i+1} ln\omega_{ij}$$
$$+ c_5 ln\omega_{1j} ln\omega_{2j} + c_6 ln\omega_{1j} ln\omega_{3j} + c_7 ln\omega_{1j} ln\omega_{4j} + c_8 ln\omega_{2j} ln\omega_{3j} + c_9 ln\omega_{2j} ln\omega_{4j} + c_{10} ln\omega_{3j} ln\omega_{4j}$$
$$+ \sum_{i=1}^{4} c_{i+10}\, 0.5 * (ln\omega_i)^2 + \sum_{g} cc_g time\ dummies_g \tag{9}$$

Equations (6) and (9) are then estimated, with the latter re-written as:

$$\mathrm{P}_j = \frac{TC_j}{q_j}\ (s_0 + s_1(lnq_j) + \sum_{i=1}^{4} s_{i+1}\,(ln\omega_{ij})) + \sum_{g} \lambda_g\ time\ dummies_g \tag{10}$$

Where, on the right hand side of the equation (10), the first term reflects marginal cost (MC), and the parameters λ_g attached to time dummies variables appearing in the last summation operator captures the potential sources of market power or premium over marginal cost. Similar to previous exercise, I impose the homogeneity of input prices by dividing the input prices and total cost by my fifth input price (price of bag). Subsequently, regression coefficients are used to estimate marginal cost and lerner index.

10.3.3 Estimation of Lerner Index: Stochastic Frontier (SF)

Cost function estimation above assumes that firms try to minimise cost with respect to output and input prices. But not all firms are likely to achieve this and that this could introduce optimisation error and should be taken into account when estimating marginal cost and mark-ups. Recently, some authors such as Kumbhakar (2012) and Coccorse (2012) addressed the optimisation error issue by introducing an error term in the regression model and use the well established stochastic frontier to estimate mark-ups. I follow their approach and recalculate the lerner index. Depending upon market conditions, profit maximising firm generally setup price (P) either equal or greater than marginal cost (MC):

$$P \geq MC \qquad (11)$$

The distance between P and MC determine the market power and level of competition in the industry. Higher and rising distance between price and marginal cost would indicate gaining of market by the firms. Lerner index (LI) measured by the divergence of price and marginal cost could be expressed by a ratio such as:

$$\mathrm{LI} = \frac{\mathrm{P-MC}}{\mathrm{P}} \qquad (12)$$

By multiplying (11) with the ratio of output (q) to total cost (TC), I get

$$\frac{Pq}{TC} \geq \frac{\partial TC}{\partial q}\frac{q}{TC} \qquad (13)$$

Price multiplied by quantity yield total revenues (TR) and the ratio Pq/TC could be interpreted as revenue to cost share (R_{it}). Similarly, right hand side could be interpreted as cost elasticity of output by taking derivative of total cost with respect to output (in log form). Hence equation (13) above could be replaced with the following:

$$R_{it} \geq \frac{\partial lnTC}{\partial lnq} \qquad (14)$$

Equation (14) is converted into equality by adding a non-negative (one sided) error term u_{it} and a symmetric two side error term (v_{it}) to account for unobserved factors, (Kumbhakar *et al.* 2012, p.114). By adding these two error terms, above equation can be reformulated to:

$$R_{it} = \frac{\partial lnTC}{\partial lnq} + u_{it} + v_{it} \quad (15)$$

Equation (15) could be considered classical example of stochastic frontier where firm unobserved effects are accommodated by v_{it} and market power (mark-ups) by one sided error term $u_{it.}$ By using the cost function of equation (9) and differentiating with respect to q and substituting into equation (15), I get the following estimable equations:

$$MC = \frac{\partial lnTC}{\partial lnq} = S_0 + S_1\ lnq_j + \sum_{i=1}^{4} \mathrm{S_{i+1}}(\mathrm{ln\omega_{ij}}) + \mathrm{u_{it}} + \mathrm{v_{it}} \quad (16),$$

and

$$R_{it} = S_0 + S_1\ lnq_j + \sum_{i=1}^{4} \mathrm{S_{i+1}}\ (\mathrm{ln\omega_{ij}}) + \mathrm{u_{it}} + \mathrm{v_{it}} \quad (17)$$

By using the appropriate distributional form of u_{it}, I could obtain an index of market power such as:

$$\frac{\mathrm{P-MC}}{\mathrm{MC}} = \frac{U_{it}}{\frac{\partial lnTC}{\partial lnq}} = \theta \quad (18)$$

From above, traditional lerner index (LI) is estimated by the following[39]:

$$L_{it} = \frac{\theta_{it}}{(1+\theta_{it})} \quad (19)$$

[39] For algebraic manipulation and detail of estimation strategy, see Kumbhakar *et al.* (2012).

10.3.4 Relative Profit: Estimation of Boone β

Another indicator of competition proposed by Griffith *et al.* (2005) and developed further by Boone (2008) is relative profit or more commonly known Boone β. This measure is based on the relative efficiency hypothesis where some firms earn higher profit because they are more efficient. Hence some firms earn more profit because of lower marginal cost at the expense of firms with high marginal cost. This measure is based on the idea that higher competition helps in transferring assets and power from the least efficient to efficient firms. An increase in competition could force some firms to leave the industry, and thus, increase either in concentration index; herfindhal index or price-cost margin could be a result of re-allocation of resources. Hence, rise in above indices could give wrong signal of decrease in competition. Boone indicator is considered more robust and overcomes many of the issues of traditional indicators and focuses on the conduct of the firms rather than outcome of the competitive conduct. Following Boone (2008), I could characterise Boone model for firm i at time t as:

$$\pi_{it} = \alpha + \beta\,(c_{it}) + u_{it}\ , \qquad (20)$$

Where π_{it} is variable profit (calculated as revenues – variable cost) for firm i at time t, β is referred to as Boone indicator and c_{it} is marginal cost. By following Boone (2008), average variable cost could be approximated by cost of goods sold divided by net sale (sales net of indirect taxes) in place of marginal cost due to the fact that marginal cost is not directly available and have to be estimated. An increase in cost reduces profit generally, but in more competitive environment, inefficient firms are punished more heavily and their profit should get reduced more. Following Schaeck and Cihák (forthcoming), β indicator could be estimated by the following:

$$ln\pi_{it} = \alpha_i + \sum_{ki=1}^{T} \beta_{k1} dk_t ln(c_{it}) + \sum_{ki=1}^{T-1} \beta_{k2} d_{kt} + u_{it} \quad (21)$$

I use profit and cost in log form. To normalise with respect to the size of the firm, variable profit (π_{it}) could be expressed as a proportion of assets. T is total number of periods (years); and d is time dummies. Time dummies are interacted with cost to get year specific estimates. A higher value of β compared to a base period would indicate an increase in competition and vice versa.

10.4. Data

Panel data reflecting a variety of variables is taken from a variety of sources, covering the period 1986 – 2011. The data set used by this study encompasses a much wider time period of post reform than most other such studies on the development in competition during post reforms regimes. To my knowledge no similar study focusing on developing countries have been able to obtain comprehensive data on a time period of this length. The significant periods of time I have highlighted both pre- and post reform can be found in Table 10.2 below.

Table 10.2: Policy Reforms in Industrial Sector

Period	Classification
1986 – 1989	Pre-reform Period
1990	Very early reform period, creating the framework for later developments
1991 – 1996	1st phase of reform – includes privatization in cement industry and entry of new firms operating under private sector
1997 - 2003	2nd phase of reforms and privatization including establishing regulatory framework

Data on cement industry firms were obtained from the company annual reports, Karachi stock exchange, APCMA, Competition Commission of Pakistan, Expert Advisory Cell (Ministry of Production and Industries, Government of Pakistan), brokerage houses in Karachi, company websites, through the exploitation of personal contacts with authors in the field who have obtained such data for use in previous studies and many others.

The final panel dataset used in this study comprises information of 21 firms and 26 years. The variables used, as well as their descriptive statistics, can be found in Table 10.3 below.

Table 10.3: Variables Description and Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Q: Quantity (mill tons)	730	860	2	6552
TC: Total Cost (mill Rs.)	1660	1144	64	7858
Y: Development Expenditure (%)[40]	4.46	1.58	2.13	7.73
Z: Construction Growth (%)	3.74	8.29	-11.17	24.35
P: Selling Price (Rs. Per ton)	4076	1165	2389	13642
W1: Wages (Rs. Per annum)	182321	60352	46321	403397
W2: Furn. Oil Price (Rs. Per ton)	9373	2202	6247	14079
W3: electricity Price (Rs. per KW)	3.82	1.26	2.04	5.64
W4: Limestone Price (Rs. Per ton)	81	21	40	117

[40] Given the importance of this variable I scaled up Y by 1000 at the estimation stage (equation (1) to get precise estimates of this important determinant of demand.

As a preliminary analysis I constructed a herfindahl index of competition by time period, the results of which can be seen below in Table 10.4. I constructed this index by using three different measures i.e. total assets, rated capacity and sales volume .The index does not suggests that there is an increase or decrease in competition during the years following the initiation of reforms in 1992. It would appear that the index value is not high and hence could indicate that there is less presence of concentration. The stability in the index though indicating no change in the status quo but contrarily, could also be suggestion of cartel members agreeing on the market share and maintaining throughout the sample period. These initial observations based on just descriptive statistics are useful but more detailed assessment is carried out by estimating competition index (λ), lerner index and some other popular indicators of competition.

Table 10.4: Herfindahl Indices

	1986	1987	1988	1989	1990	1991	1992
Assets	0.11	0.11	0.11	0.10	0.09	0.08	0.10
Capacity	0.10	0.09	0.09	0.09	0.09	0.08	0.08
Sales	0.11	0.09	0.09	0.09	0.09	0.08	0.08
	1993	1994	1995	1996	1997	1998	1999
Assets	0.11	0.11	0.11	0.09	0.10	0.10	0.11
Capacity	0.08	0.08	0.08	0.07	0.07	0.07	0.08
Sales	0.08	0.08	0.09	0.07	0.07	0.07	0.08
	2000	2001	2002	2003	2004	2005	2006
Assets	0.09	0.11	0.09	0.10	0.09	0.10	0.12
Capacity	0.07	0.08	0.07	0.07	0.07	0.08	0.11
Sales	0.08	0.08	0.07	0.08	0.08	0.08	0.08
	2007	2008	2009	2010	2011		
Assets	0.13	0.11	0.10	0.10	0.12		
Capacity	0.11	0.10	0.09	0.09	0.11		
Sales	0.11	0.11	0.10	0.11	0.12		

10.5. Estimation and Explanation

Equation (1) and the (4) are jointly estimated using 2SLS non-linear full information maximum likelihood method. The results of which can be found below in Table 10.5. I estimated different specification models by selecting different time periods for reforms to take effect such as 1990 (very early period before initiation of privatization), 1993: immediate year of first phase of post privatization, 1995: after three years of privatization and 1998: start of second phase of privatization. In the last attempt, I portioned the reforms periods into two sub-periods (first: 1990 to 2003 and second, 2004 to 2011) to observe any divergence between these two post reforms periods in term of prices and output.

Similar to other empirical studies in estimating the cost function, I imposed homogeneity in input prices. My theoretical expectations are generally confirmed with price coefficient negative ($a_1 < 0$ and statistically significant), income coefficient (development expenditure) positive $a_2 > 0$, substitute coefficient negative $a_4 < 0$ (for most of the models estimated) and downward slope demand curve = $a_1 + a_3z + a_5Y < 0$. Further, for the identification of λ, either a_3 or a_5 should be significant. In my case, a_3 coefficient is statistically significant as well a_5 in some models.

Starting with my base model (column 2 & 3), overall, models fits the data well given the fact that I am using disaggregated individual firms level data; twelve of the fifteen coefficients are statistically significant and the λ is estimated 0.02, with a standard error of 0.01. This indicates a statistically significant index of competition and an overall some market power. As the coefficient is statistically different from zero, I do reject the null hypothesis that the cement industry operates under conditions of perfect competition. Interestingly though, as the λ value is relatively much closer to zero than to one, I can be certain that the coefficient is not equivalent to one, which would have indicated the firms operating under the conditions of pure monopoly. Due to very low value of index, I can therefore conclude that the competitive conditions are not completely imperfect and industry does operated relatively, competitively over the whole sample period. This result is consistent with APCMA version and Competition Commission of Pakistan.

Next, I re-estimated the above model by introducing a shift dummy, similar to Gruben (2003), to note any divergence from competitive conditions in post deregulation and privatization period. An indication of statistically significant positive λ in post deregulation period would indicate the divergence from competitive conditions. I included a dummy variable =1 for period 1993 onward and 0 otherwise. Results of this exercise are reported in Table 10.5 (column 6 & 7).

Similar to above, the model fits the data well with only three coefficients insignificant. Substitute variable coefficient, though have wrong sign and significant. My point of interest variable λ and λdereg are both significant. Positive λ indicate industry operating under competitive structure with some market power before privatization. Negative λ in post 1993 is an indication of excess capacity and excess supply as compared to what is determined by marginal revenues and marginal cost (marginal cost exceeding marginal revenue). This is not surprising results given the fact that financial performance of these privatized companies generally and industry particularly was not encouraging in post privatization period (see chapter on financial performance).

Combing λ and λdereg together, I get the structure where some market power is being exercised by these firms (similar to base model). The value of -λdereg > 0 is also an indication that due to some reason producers are producing and supplying output more than competitive level. Added capacities has put extra pressure on the supplier to produce more to meet interest payments on funds borrowed from banks and other financial institution.

To further explore this, I re-estimated the model whereby, I introduced two shift dummy variables for two post reforms period. Dummy variable =1 for the period 1990 - 2003, and 0 otherwise. Another dummy variable =1 for the period 2004 to 2011 and 0 otherwise. This exercised is carried out to see any changes in competitive conditions in two separate periods i.e. immediately after reforms (first 10 years of reforms period) and then in subsequent years. λ value in this formulation is positive and statistically significant (column 12 & 13). This again is evidence that industry is operating under competitive condition. The first shift dummy in this case (λdereg) captures period 1990 – 2003, and indicates a decrease in competition, and the coefficient is statistically different from zero. The second shift interactive term ($\lambda dereg_1$) suggests a degree of excess capacity over the period 2004 onward and is statistically significant. This seems to indicate that, in the latter part of reforms period there was a significant capacity addition that forced firms to operate at more output compare to competitive level. Interestingly, a significant part of this output was exported to neighbouring countries. The sum of λ and the interactive shift coefficient (λdereg and λ$dereg_1$) provides a degree of post-1990 percentage deviation of aggregate output from the competitive equilibrium level regardless of functional form of demand and supply (Shaffar (1993); page 58, footnote 9). This figure is 31% less than competitive level.

Overall, my final model indicates a decrease in competitive conditions and thus industry has started moving away from perfect condition but for way from monopoly. Consistent with profit maximising firm behaviour, firms could move to long term equilibrium condition. This adjustment period for Canadian banks had been suggested 10 years (Shaffar (1993) and Raj *et al.* (1979)).

Table 10.5: Full Estimation Maximum Likelihood 2SLS Estimates of Competition Index (λ)

	Base Model		***Reforms Effect: 1990***		***Reforms Effect: 1993***		***Reforms Effect: 1995***		***Reforms Effect: 1998***		***Reforms Effect: 1990-2003, 2004-11***	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Parameter	***Estimate***	***Approx Std Err***	***Estimate***	***Approx Std Err***	***Estimate***	***Approx Std Err***	***Estimate***	***Approx Std Err***	***Estimate***	***Approx Std Err***	***Estimate***	***Approx Std Err***
Demand Equation												
a0	*1.749435***	*0.5805*	*1.442654***	*0.5468*	*1.403855***	*0.6343*	*1.172164***	*0.5797*	*1.120868**	*0.6153*	*2.671119****	*0.706*
a1	*-0.000720****	*0.000117*	*-0.00052****	*0.000113*	*-0.00064****	*0.000123*	*-0.00051****	*0.00011*	*-0.00063****	*0.000115*	*-0.00096***	*0.000123*
a2	*0.000028***	*9.07E-06*	*2.54E-06*	*0.000011*	*0.000034****	*9.97E-06*	*4.88E-06*	*0.000012*	*0.000039****	*9.95E-06*	*0.000018**	*0.000011*
a3	*0.000051****	*3.47E-06*	*-0.00005****	*4.7E-06*	*0.000049****	*3.58E-06*	*-0.00005****	*4.57E-06*	*0.000049****	*3.47E-06*	*0.00006****	*3.71E-06*
a4	*-0.21911****	*0.0274*	*0.19658****	*0.0282*	*-0.20928****	*0.0284*	*0.189412****	*0.0274*	*-0.18853****	*0.0279*	*-0.26178****	*0.0297*
a5	*-5.87E-09****	*1.74E-09*	*-1.7E-11*	*2.64E-09*	*-7.1E-09****	*1.82E-09*	*-1.6E-10*	*2.56E-09*	*-7.2E-09****	*1.64E-09*	*-3.4E-09***	*1.76E-09*
a6	*3.70E-07*	*5.94E-07*	*-3.6E-07*	*5.58E-07*	*3.07E-07*	*6.05E-07*	*-2.6E-07*	*5.55E-07*	*-1.9E-07*	*6.09E-07*	*5.2E-07*	*6.53E-07*
a7	*0.329778*	*0.2306*	*-0.14629*	*0.1965*	*0.348286*	*0.2313*	*0.016368*	*0.1877*	*0.473605***	*0.1566*	*0.428773*	*0.2602*
Supply Equation												
λ	*0.020397***	*0.0107*	*0.056571*	*0.0679*	*0.145747***	*0.0576*	*0.015994*	*0.072*	*0.149719**	*0.086*	*0.263543****	*0.0774*
b1	*3.550252****	*0.2784*	*3.201444****	*0.337*	*3.825612****	*0.355*	*3.079766****	*0.333*	*3.752331****	*0.3425*	*4.52352****	*0.4525*
b2	*0.226618****	*0.00904*	*0.211572****	*0.0098*	*0.230195****	*0.0101*	*0.209055****	*0.00945*	*0.225583****	*0.00933*	*0.229457****	*0.011*
b3	*-0.11298****	*0.0267*	*-0.10859****	*0.0273*	*-0.14641****	*0.0305*	*-0.11026***	*0.0422*	*-0.14808****	*0.0438*	*-0.22108****	*0.0386*
b4	*-0.12159**	*0.0652*	*-0.13195***	*0.0603*	*-0.20377***	*0.0805*	*-0.12691**	*0.0731*	*-0.1696***	*0.076*	*-0.14194***	*0.0706*
b5	*0.075506*	*0.0764*	*0.011336*	*0.0831*	*0.11866*	*0.0813*	*0.01336*	*0.086*	*0.129461*	*0.0987*	*0.046675*	*0.0888*
b6	*-0.14301****	*0.0333*	*-0.09977***	*0.0384*	*-0.16479****	*0.0409*	*-0.08633***	*0.0344*	*-0.15387****	*0.0363*	*-0.15248***	*0.0497*
λdereg			*-0.03858*	*0.0668*	*-0.12839***	*0.0577*	*0.001358*	*0.0736*	*-0.13308*	*0.0874*	*0.27979****	*0.0571*
$\lambda dereg_1$											*-0.23307***	*0.0768*
Models Statistics												
Adj. R^2												
Q	*0.3423*		*0.3366*		*0.3456*		*0.3395*		*0.3627*		*0.2931*	
P	*0.4493*		*0.4514*		*0.4323*		*0.4570*		*0.4229*		*0.3287*	

*Notes: *** significant at =<1% significance level*
*** significant at =<5% significance level*
** significant at >5% significance level*

Table 10.6 shows the estimates of six different competition measures (three each for non-parametric and parametric methods). I start with widely used traditional non-parametric measure of competition herfindhal index (H). This measure indicates no change in the competition in post reforms period. A marginal increase in competition immediately after reforms was offset by a decrease during 2007 to 2011. Concentration index (C_3) approximated by top three firms' market share also depicts the similar trend. Third measure I use is price cost margin (weighted as well as un-weighted) indicate decrease in competition during post de-regulation period.

Table 10.6 displays average prices and cost alongside marginal cost using regression coefficient of CV model. Some interesting trends could be spotted. Firstly, average prices during the sample period remained roughly same with the exception of the period 1994 to 1999, when prices declined from Rs. 4500 to Rs. 3900 per tonne. By looking at the average and marginal cost though, one could easily observe that cost of producing cement has been declining continuously since the mid 1990s. This could be better explained by firms using more advanced technology (dry process) as well as developments in competitive conditions.

It seems that by ignoring the magnitude, the lerner indices have been rising since the time deregulation and privatisation was implemented irrespective of index measured by CV or stochastic frontier. Hence, firms as a whole charged for more than marginal cost since privatisation and deregulation. Particularly, since 1999, increase in lerner index (decrease in competition) has been steep. This is interesting given the fact that decrease in the marginal costs had not been passed on to the consumers. Boone beta index that is considered more robust compared to lerner index also confirms the similar findings. One criticism of Boone beta is the assumption of constant marginal (average variable cost) with respect to change in output. As a robustness check, I use marginal cost derived from CV model and recalculated beta for pre and post deregulation/privatisation period. My beta coefficients values were 0.974 for 1986-91, 0.703 for 1992-99, 0.655 for 1999-11, 0.492 for 1999-06 and 0.686 for 1992-11. Hence, ignoring the magnitude of coefficients, conclusions seem to be the same that competition levels have decreased over time.

Table 10.6 also depicts industry profitability measured through return on assets (ROA). Since 1995, with the exception of 2004 to 2006, profitability has been declining and firms had earned smaller margins on investments. This could be due to two reasons. Firstly, a significant investment has been made to upgrade the old equipments and machinery and, to add capacities to meet local and export demand.

Table 10.6: Estimation of Competitive Conditions (Other Indices)

	H	C_3	PCM	WPCM	LI (CV)	LI (SF)	Boone β (2005)	MC	AC	ROA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1986-87	0.097	0.392	0.556	0.574						
1988-89	0.087	0.350	0.569	0.567	0.347	0.135	3.327	3339	3623	8.813
1990-91	0.085	0.352	0.540	0.553	0.297	0.139	2.384	3470	3685	3.833
1992-93	0.081	0.319	0.587	0.614	0.356	0.138	1.810	3151	3334	9.448
1994-95	0.083	0.328	0.613	0.646	0.343	0.132	1.123	3348	3793	10.604
1996-97	0.072	0.291	0.607	0.629	0.418	0.149	2.724	2253	2611	-1.073
1998-99	0.076	0.324	0.581	0.616	0.367	0.166	2.437	2273	2704	-5.122
2000-01	0.078	0.352	0.545	0.579	0.427	0.176	2.315	2326	2677	-1.851
2002-03	0.074	0.339	0.572	0.605	0.452	0.185	2.233	2198	2497	0.149
2004-05	0.078	0.352	0.582	0.612	0.518	0.188	1.545	1891	2162	8.965
2006-07	0.096	0.424	0.522	0.575	0.443	0.184	1.316	2049	2252	5.367
2009-09	0.104	0.451	0.435	0.492	0.447	0.193	2.003	2330	2550	-0.859
2010-11	0.114	0.491	0.381	0.451	0.532	0.210	1.656	1794	2005	-1.796
1986-91	*0.090*	*0.365*	*0.555*	*0.564*	*0.322*	*0.137*	*2.856*	*3405*	*3654*	*6.323*
1992-98	*0.077*	*0.308*	*0.599*	*0.626*	*0.371*	*0.146*	*2.023*	*2756*	*3110*	*3.464*
1999-06	*0.079*	*0.356*	*0.571*	*0.605*	*0.441*	*0.180*	*1.969*	*2147*	*2458*	*1.502*
2007-11	*0.109*	*0.467*	*0.418*	*0.482*	*0.474*	*0.196*	*1.658*	*2058*	*2269*	*0.904*
1992-11	*0.086*	*0.367*	*0.542*	*0.582*	*0.430*	*0.172*	*1.916*	*2361*	*2658*	*2.383*

Notes:

1) H: Herfindhal index (total assets) defined as

$$\sum_{i=1}^{N} Si^2$$

.

2) C_3= Market share of top 3 firms.

3) PCM=

$$\sum_{i=1}^{N} \frac{\text{sales} - \text{variable cost}}{\text{sales}}$$

4) WPCM is weighted PCM (weights are determined by market shares of total assets).

5) LI (CV) = $\frac{\lambda}{p}$. λ is estimated by using system of two simultaneous equations using the three stage least square (3SLS). The instruments used are gdp growth rates, government development expenditures, central bank discount rates, total population, construction sector growth rates, quantity of cement sold by each firm, square of quantity of cement sold, input prices (furnace oil prices, coal prices, limestone prices, labour wages), interaction of quantity of cement sold and input prices, public, age of the firm, value of cement export of each firm, 12 time dummies (t88-89 to t10-11).

6) LI (SF) = Lerner index calculated using the formula LI = $\theta/(1+\theta)$. See text for detail and Kumbhakar *et al.* (2012). Equation (18) is estimated using panel data time-invariant fixed-effects model (least square dummy variable approach).

7) Boone β (2005) is calculated by regressing the cost ratio (cost of goods sold (cogs) to net sales) on profit (net sales – cogs). Both variables are in logs. Arellano-Bond dynamic panel-data estimation method used by interacting yearly time dummies with cost ratio. Time dummies also included as independent variables. One lag of profit included as a regressor to account for dynamic effect. This is similar to Schaeck and Cihák (forthcoming).

8) MC = Marginal cost (Pak. Rs. per tonne) derived from CV model.

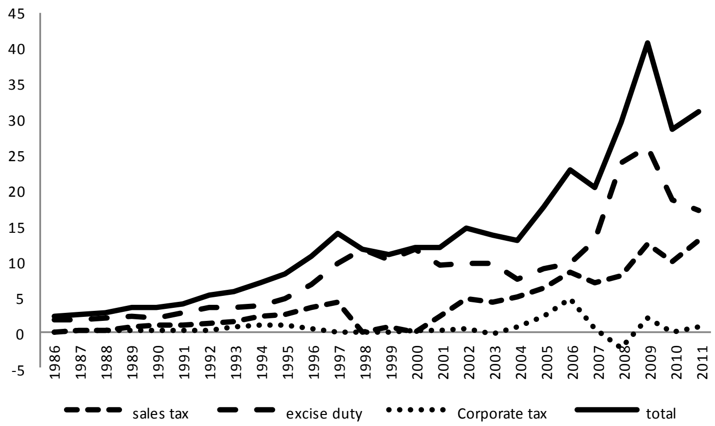
9) AC = Average total cost (Pak. Rs. per tonne) calculated by dividing total cost by total cement dispatched (sold in tonnes)

10) ROA = Return on assets (%) by dividing net profit after tax by total assets.

This has certainly increased the value of fixed assets and consequently total assets significantly. Secondly, due to the way, I have calculated the Lerner index; some costs are not accounted for, such as cost of capital (interest paid on bank loans) and depreciations etc.

Furthermore, ROA is net return on assets after deducting all government levies and taxes (directly and indirectly). An increase in the government share from the total pie could leave less residual left to be distributed/kept to the shareholders. Figure 10.1 shows tax payments of the industry during the sample period. It is apparent from the figure, that government had been the main beneficiary. Tax receipts of the governments have been rising since 1996.

Figure 10.1: Total Taxes (Pak. Rs. billions) Paid by the Cement Industry



10.6. Conclusion

This chapter has sought to test for the presence of competition in the cement industry over the period between 1986 and 2011. The competition index (λ) alongside lerner index and other non-parametric indices are estimated to test for the market power of the average firm when the market is in Cournot equilibrium. The interactive shift dummies terms were included to test for changes in the level of competition over time. The estimates of λ from varying model specifications indicate that to a greater or lesser extent, the cement sector is operating under conditions of near monopolistic competition in post reform. It should, however, be noted that the precise estimate of λ places the level of competition slightly nearer to the perfectly competitive structure during 1990 to 2003 and then had moved away to long term equilibrium. Indeed, for one of the model specifications used (that did not feature any time shift dummies) it was not possible to reject the hypothesis that the cement sector was almost perfectly competitive. Based on other indicators, though one gets the message that the deregulation and privatization measures introduced by the government in the early 1990s have at least partly made industry relatively less competitive over time and there are signals of firms gaining market power.

CHAPTER 11

Summary and Conclusions

This chapter presents the main findings, highlights the issues not addressed in this study and provides future directions of research

11.1. Introduction

The aim of this study changes in the operation and behaviour of firms as a result of deregulation and privatization introduced since early 1990s. This exercise was aimed to provide useful information and provide a direction for policy makers, government, investors, competitors and general public in the area of industrial economics/management and evaluation of policy reforms and its effect on the individual firms and industry.

In order to achieve these objectives the study carried a detailed and careful analysis of the operational performance of the industry generally and privatized firms particularly. Sample is divided into two sub-periods covering the period of 1986-91, a public ownership or pre- reforms period, and 1992-2011, a private ownership period or post reforms period. The main consideration in this analysis was to observe significant changes in the management of resources as a result of change of ownership from public to private sector. A significant effort was made to distinguish the industry/macroeconomic effects from ownership effects.

A lot of studies in this area, authors looked at either firms' efficiency/productivity analysis, or financial performance or cost benefit analysis through social accounting framework in some earlier studies. This study aim was to narrate a complete story rather than bits and pieces. The study carried out the analysis for overall industry, privatized firms, private firm and public sector firms. The robustness of the ownership effects is checked by comparing the trend in performance of privatized firms (predominantly those firms privatized in early 1990s) with those firms, which remained under public ownership till the time they privatized (by 2003, all public sector firms were privatized) and the firms starting operation under private ownership and remained in private sector throughout the sample period. A non-parametric test is used to test the statistical differences in performance of pre- and post reforms periods (in evaluation of financial performance).

The study is able to provide information on the following broad issues in pre- and post change of ownership time periods including:

- Financial performance
- Social costs and benefits
- Resource management in term of efficient use of inputs and changes in total factor productivity
- Adjustments in labour uses
- Competition conditions and gaining of market power in post reforms period

In the remaining part of this chapter, the main results from the empirical investigation will be summarised and areas for future research in the field will be highlighted.

11.2. Summarising the Discussion

The first step in the performance evaluation process was to define a suitable criterion of performance measurement. The debate and controversy regarding performance evaluation of public and private ownership is still alive in the empirical economics literature due to differences in objectives of two ownership structures and lack of consensus on performance measurement criteria. This study appreciated the utility of different methods to assess the performance of firms and used them in at appropriate places.

The study starting point was assessment of qualitative changes and evaluation of commercial profitability and operating efficiency. Different financial ratios deduced from the empirical literature predominantly from Megginson *et al.* (1994) work were used in this regard. Hypothesis regarding profitability, efficiency, capital investment and outputs were tested. In the second stage, accounting information is rearranged into economic relevant numbers. This resulted in calculation of public profit and profitability. An adjustment was made to non-efficiency factors such as prices and endowments of fixed factor of production. In subsequent analysis, I estimated technical and cost efficiencies, total factor productivity indices, labour use efficiencies and competitive conditions in pre- and post reforms period.

The financial and economic performance carried in this way reveals the following information/trends:

- I started my evaluation of firms' behaviour by looking at the qualitative changes that were introduced immediately after the change of ownership from public to private sector. I linked these changes to prevailing economic and competitions conditions and conclude that deterioration in the economic activity for the last few years might have depressed the demand for cement. As a consequence firms have to either export in highly competitive market or operate at sub-optimal scale of operation. By looking at capacity utilization figures, I noticed a significant decline in capacity utilizations in post reforms period.

- The performance of firms in term of trends of margin on sales could be explained by four sub-periods. The margin improved immediately after privatization during 1992-95 followed by continuous decline during 1994-99. But soon after, the margin significantly increased during 2001 to 2005. The trend however reverted to decline since 2006 with little improvement in between. The results are robust irrespective of alternative ratios of profitability (like using return on equity or assets as well as gross profit margin). Significant improvement during immediate period of reforms is not surprising due to depressed margins under public ownerships and firms gaining power to set prices and outputs as per market demand and supply. Similarly better performance during 2001 to 2005 is also expected due to high economic growth and effective economic management by the professional managers.

- Financial efficiency results in term of labour productivity, capacity utilization, average collection period and inventory turnover also show some interesting and significant patterns. Capacity utilization kept falling continuously and this has resulted in sub-optimal production levels for same years. Labour productivity measured as a simple ratio of output to number of workers improved in the immediate period of privatization. The average collection period showed a significant increase for private and privatized firms indicating a more lenient policy of credit sales in the post privatization regime. This result is expected because as the competition gets tense, the amount of credit sale would increase to keep the loyal customers happy.

- The study revealed a significant change and upward trend in output (measured by real sales) and capital investment on fixed endowments. These results are similar to Megginson *et al.* (1994). The increase in investment was partly due to aggressive policy of optimization and expansion by the new private management immediately after the transfer of ownership. This is encouraging and expected. Years of negligence and under investment under public ownership made these firms unable to meet the demands due to breakdown in technology. Further, lot of firms operating in 1980s using wet process of production were unable to compete with new private firms using smart and cost efficient dry process technology. Hence, these firms made a lot of investment in gradually moving to this new dry process technology. Further, as a result of rising energy prices, firms cost of production increased significantly since 2000. To cope with this, lot of firms converted furnace oil based energy generation units to coal fired one. All this needed a significant investment too.

- Dividend record of the privatized firms, however, has not been promising. Both ratios of dividend to sales and income did not show any significant upward movement in post reforms period. A significant increase in dividend was followed by years of no dividend payouts. Privatized firms followed a general industry trend. This typical attitude is however similar to overall trend in terms of dividend payments of manufacturing sector. The research in this area showed that dividend payouts are cyclical in Pakistan. Hence, one could conclude that change of ownership has not changed this trend.

- Adjusted social accounting based profitability measures showed some interesting trends in post reforms period. Despite the fact that new management expanded their scale of operation by investing heavily into capacity additions, the study observed a significant improvement in the public profitability. Public profit and profitability followed the same pattern evaluated at nominal as well as real prices. These results are similar to Jones *et al.* (1994) who concluded the superior performance in private ownership period by using the same social cost benefit ratios. Non-parametric total factor productivity approach is similar to public profitability concept and is widely used in performance evaluation studies. This ratio at nominal and real prices also improved in private ownership period, however, the variations in the ratio were lees compared to public profitability. Overall, non-parametric method of productivity indicates that change of ownership has made the firms more productive.

- The study focus then moved from non-parametric (financial and social ratios) based measures of performance evaluations to econometric estimation of frontier translog production and cost function estimation to estimate firm level technical as well as cost efficiency estimates. By following literature in this area, this study used main inputs and outputs to estimate the parameters of production technology. Estimation of parametric stochastic production/cost function is very popular and widely used by empirical researchers. But due to strong assumptions and a *priori* functional form, this method has been criticised recently. Researchers have started using more of alternative measures to estimate technical and cost efficiencies including non-parametric Data Envelopment Analysis (DEA). This method has seen lot of use and improvement in the last 10 years. This study also used this method to contrast efficiency results derived from parametric stochastic frontier. The results revealed that technical efficiency of the privatized firms did not improve during 1993-2011. The firms however, became more cost efficient, which led to an overall increase in total factor productivity. DEA based efficiency estimates confirmed the stochastic frontier findings.

- A decomposition of total factor productivity into scale and technical change effect reveals a significant productivity growth and that improvement in TFP is predominantly determined by technical change effect in post reforms period. Based on different specifications of production function, the study concludes that contrary to disappointing technical efficiency results, the industry witnessed a reasonable total factor productivity growth in post reforms period generally and during 1997 to 2011 particularly. Gains in productivity in post privatisation are similar to Estache *et al.* (2002), Cullinane and Song (2003), Amess and Roberts (2007) but contrary to Saal and Parker (2001). These results are also consistent to international experience. Megginson and Netter (2001) who reviewed the empirical literature on the issue concluded that available literature is generally supportive of the notion that firms improve their performance in post privatisation period. Investment in new technology appears to be having an effect on the production process in the post reforms period. As a result of significant capital investment, firms have experienced significant technological change during 1997 to 2011. Improvement in technology is similar to Saal *et al.* (2007) who estimated technological improvement. My technical change improvement is higher than Saal 2007) improvement of 2.19% for UK W&S companies. Further, firms appear to be using labour and capital more and saving fuel and material. Saving in fuel is similar to other studies using cement industry data (i.e. studies using Swedish cement industry data by Kumbhakar *et al.* (1992) and Kumbhakar (2002) for

US airlines). The substitution of fuel is also expected as the energy prices in the last 10 years had been continuously going up and firms had been substituting furnace oil technology with coal fired technology to generate energy.

- One of the objectives of privatizing public enterprises was to make these firms viable by reducing their wage bills. It was believed that overstaffing in the public sector firms had made them less competitive compared to firms operating under private ownership. As a result of privatization, a significant number of workers were encouraged to leave the job by taking golden handshake. One of the aims of this study was to evaluate the effectiveness of this policy in the post reforms and golden handshake period by estimating efficiency scores of labour use and compare it with pre- reforms period. Labour demand function was estimated to see the impact of reforms on labour use efficiency and the substitutability of capital and labour. Contrary to an expectation of improvement in labour use efficiency, labour efficiency levels had actually gone down in post reforms period. This is surprising but then expected because, majority of those workers who opted for golden handshake were rehired on contract basis later on. Further, due to depressed demand and low capacity utilization, firms were unable to use their workforce intelligently and efficiently in some years of post reforms period.

- Since the change of ownership and reforms in early 1990s, lot of people have been protesting that cement industry producers are colluding and charging higher prices. Collusion by the cement producer is not a new thing as lot of other countries in developing, developed and former socialist countries .had seen such behaviour. One of the Pakistani investigation authorities, FIA had twice raided cement producers offices in the last few years to find any documentary evidence of cartel formation without any success. Competition Commission of Pakistan also carried out a study to find out any evidence of monopoly formation in the last few years. The findings of the study were not clear. This study also tested the level of competition in post reforms period by using the popular indices of competition. The study conclude that industry has moved from highly competitive with no market power to some level of market power and has become relatively less competitive. However, I am unable to say that firms are operating under complete monopoly position.

11.3. Contributions and Limitations of the Study

This study tried to comprehensively evaluate the consequences of selling cement manufacturing units. The reason that cement industry was chosen was due to the fact that cement is almost homogenous product and econometrically, estimation of production technology would require this strong assumption. Further, significance of this industry in contributions to national exchequer and export receipts is well documented and appreciated in the national press and media. Allegations of cartel forming and subsequent raids on the offices of association of producers were added motives to research this industry. As for as I am aware, no such study exists which has used such a long data set in carrying out detailed analysis of the policy. Hence, the contribution of this study into the literature of ownership effect on performance could be significant. Despite these factors, some limitations of the study must be highlighted in this section. In the following discussion, I discuss the issues not addressed adequately in this study.

Generalization of findings: The effect of reforms on the cement industry could reveal just one side of the story. Lot of other industries which were privatised at the same time like automobile, edible oil, ceramics etc. may have experienced different market conditions and environment to operate. Hence generalizing cement industry results to judge the effectiveness of reforms could be misleading for the entire manufacturing sector. Initially, I intended to use 4-5 industries data to compare and contrast the results across different industries. But the idea of other industries was dropped after going through extremely difficult time to collect and compile the data to do a comprehensive analysis,

Data quality: second issue is related to data quality. Lot of effort was made to get the comparable and complete data on the balance sheet, profit and loss accounts and other operational indicators. I have to visit many places and use number of different sources of data and documents, including government ministries, stock exchange libraries, development finance institution offices, interaction with the industry experts and physical visits to producers associations to conduct interviews. An utmost effort was made to make this data as accurate and as comparable as possible across these different sources. In some cases, I have to impute some data points using missing values imputation method for variables such as like workers strength for few years. Due to all these reasons, quality of the data may have been little compromised. Hence, despite the fact that this is the first comprehensive study of the evaluation of the

Pakistani privatization programme, a great care should be exercised while interpreting and generalising this study results.

Econometric issue: A significant time, resources and skills were used to choose appropriate econometric techniques to calculate cost and production function parameters and competition indices as well as labour use efficiencies. But due to well known issue related to translog specification (i.e. over fitting), a great care should be exercised in interpreting and generalising these findings. In some cases (for example competition indices), the choice of instruments is extremely important in estimating the demand and supply functions. Choice of substitute of cement, and demand booster was based on some available literature and feedback from industry expert. But these proxies could be subject to debate. Further, lot of experimentations was done to get stable coefficients and econometric tests were conducted to verify the relevance of instruments used in the estimation. But still, nonetheless, few issues may have not been addressed adequately.

11.4. Areas of Future Research

As mentioned above, given the time and resources, the study would have used other privatized industries data to compare and contrast the results to get some idea of how reforms have changed the behaviour of different firms operating in different industries and different market environments. Future research in this area should address this issue and more industries should be evaluated alongside cement industry to get a complete picture. Further, this study carried out some partial social cost benefit analysis of the privatization policy using cement industry as a case study. But future study should carry out a comprehensive cost benefit analysis of the privatization and deregulation policy in term of consumer surplus, producer surplus, government benefits and competitors surpluses/losses.

REFERENCES

Aftab, S., and Khan, S.R, (1995), “Comparative Privatisation Experience in Pakistan: Employee vs Private Ownership”, *Sustainable Development Policy Institute* (SDPI), Islamabad, Pakistan.

Aharoni, Y. (1986), “The Evaluation and Management of State Owned Enterprises”, Cambridge, Mass.: Ballinger.

Ahluwalia, M. S., (2002), “Economic Reforms in India since 1991: Has Gradualism Worked?” *Journal of Economic Perspectives*, Vol. 16, Issue 3, pp: 67-88.

Aigner, D. J., Lovell, C. A. K and Schmidt, P, (1977), “Formulation and Estimation of Stochastic Production Function Models”, *Journal of Econometrics*, Vol. 6, Issue 1, pp: 21–37.

Altaman, I. E. (1968), “Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy”, *Journal of Finance,* Vol. 23, Issue 4, pp: 589-605.

Altaman, I. E. (1983), “Corporate Financial Distress”, Whiley, New York.

Amess, K., and Roberts, B.M. (2007), “The Productivity Effects of Privatization”, *International Review of Financial Analysis*, Vol. 16, pp: 354-366.

Angelini, P., and Cetorelli, N. (2003), “The Effects of Regulatory Reform on Competition in the Banking Industry”, *Journal of Money, Credit and Banking*, Vol. 35, pp: 663-684

Appelbaum, E. (1982), “The Estimation of the Degree of Oligopoly”, *Journal of Econometrics*, Vol. 19, pp: 287-299.

Asaftei, G., Kumbhakar, S.C., and Mantescu, D. (2008), "Ownership, Business Environment and Productivity Change", *Journal of Comparative Economics*, Vol. 36, pp: 498-509.

Atkinson, S. E., and Primon, D., (2002), "Stochastic Estimation of Firm Technology, Inefficiency and Productivity Growth Using Shadow Cost and Distance Functions", *Journal of Econometrics*, Vol. 108, 203-225.

Baltagi, B. H. and Rich, D. P., (2005), "Skill Based Technical Change in US Manufacturing: A General Index Approach", *Journal of Econometrics*, Vol. 126, Issue 2, pp: 549-570.

Baltagi, B. H., and J. M. Griffin (1988) "A Generalized Error Component Model with Heteroscedastic Disturbances, *International Economic Review*, Vol. 29, Issue. 4, pp: 745-753.

Barberis, N., Boycko, M., Shleifer, A., and Tsukanova, N. (1996), "How Does Privatization Work? Evidence from the Russian Shops", *Journal of Political Economy*, Vol. 104, pp: 764–790.

Bartel, A.P., and Harrison, A.E. (2005), "Ownership versus Environment: Disentangling the Sources of Public Sector Inefficiency", *Review of Economics and Statistics*, Vol. 87, pp: 135-147.

Battese, G, E., and T. Coelli (1988), "Prediction of Firm Level Technical Efficiencies with a Generalized Production Function and Panel Data" *Journal of Econometrics*, Vol. 38, pp: 387-390.

Battese, G, E., and Coelli T. .(1992), "Frontier Production Function Technical Efficiency and Panel Data: with Application to Paddy Farmers in India" *Journal of Productivity Analysis*, Vol. 3, pp: 233-268.

Battese, G. E., Heshmanti, A., and Hjalmarsson, L., (2000), "Efficiency of Labour Use in the Swedish Banking Industry: A Stochastic Frontier Approach", *Empirical Economics*, Vol. 25, pp: 623-640.

Battese, G.E., Heshmati, A., Hjalmarsson, L., (2000). Efficiency of Labour Use in the Swedish Banking Industry: A Stochastic Frontier Approach. *Empirical Economics*, Vol. 25, pp: 623 – 640.

Battese, George E., Sohail J. Malik and Sumiter Broca. (1993), "Production Function for Wheat Formers in Selected Districts of Pakistan: An Application of a Stochastic Frontier Production Function with Time-Varying Inefficiency Effects" *Pakistan Development Review*, Vol. 23, Issue 3, pp: 233-268.

Battese, George, E., and Coelli T.J. (1995), "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data" *Empirical Economics*, Vol. 20, pp: 325-332.

Bauer, P. W., Berger, A. N., and D. B. Humphrey, (1993), "Efficiency and Productivity Growth in U.S. Banking", in Fried, H. O., Lovell, C. A. K and Schmidt, S. S., The Measurement of Productive Efficiency: Techniques and Applications, Oxford University Press, pp: 386-413.

Bejger, S. (2011). Polish Cement Industry Cartel-Preliminary Examination of Collusion Existence, *Business and Economic Horizons*, Vol. 04, pp: 88-107.

Bejger, S. (2012), Cartel in the Indian Cement Industry: An Attempt to Identify it, Economics Discussion Paper No. 2012-18.

Bengali, Kaiser. (1998), "Social Dimensions of Privatisation in Pakistan" International Labour Organization (ILO), Geneva, Switzerland.

Benjamin, D., (1992), “Household Composition, Labour Markets, and Labour Demand: Testing for Separation in Agricultural Household Models”, *Econometrica,* Vol. 60, Issue 2, pp: 287-322.

Bennet, T., and Johnson, M.H. (1979), “Public vs. Private Provision of Collective Goods and Services: Garbage Collection Revisited”, *Public Choice*, Vol. 34, pp: 55-64.

Berger, A. N. and Humphrey, D. B., (1997), “Efficiency of Financial Institutions: International Survey and Directions for Future Research”, *European Journal of Operational Research,* Vol. 98, pp: 175 – 212.

Berger, A. N. and Mester, L. J., (2001), “Explaining the Dramatic Changes in Performance of U.S. Banking: Technological Change, Reform and Dynamic Changes in Competition”, Working Paper Federal Reserve Firm of Philadelphia, No. 6, April.

Bhandari, A. K. and Heshmati, A., (2005), “Labour Use and Its Adjustment in Indian Manufacturing Industries”, *Global Economic Review,* Vol. 34, Issue 3, pp: 261 – 290.

Bhaskar, V. and Khan, M. (1995) “Privatization and Employment: a Study of the Jute Industry in Bangladesh”, *American Economic Review*, Vol. 85, pp: 267-273

Bhaumik S.K. and Dimova, R., (2004), “How Important is Ownership in a Market with a Level Playing Field? The Indian Banking Sector Revisited”, *Journal of Comparative Economics*, Vol. 32, Issue 1, pp: 165 – 180.

Bikker, J. A. and Haaf, K., (2002), “Competition, Concentration and Their Relationship: An Empirical Analysis of the Banking Industry”, *Journal of Banking and Finance,* Vol. 26, Issue 11, pp: 2191 – 2214.

Bishop, M. and Green, M. (1995) “Privatisation and Recession – The Miracle Tested”, CRI Discussion Paper 10, London: Centre for the study of Regulated Industries.

Bishop, M. and Thompson, D. (1992), “Regulatory Reform and Productivity Growth in the UK”s Public Utilities”, *Applied Economics*, Vol. 24, pp: 1181-1190.

Bishop, Matthew, R., and John A. Kay, (1989), “Privatisation in the United Kingdom: Lessons from Experience” *World Development*, Vol. 17, Issue 5, pp: 643-657.

Boardman, A.E., and Vining, A.R. (1989), “Ownership and Performance in Competitive Environment: A Comparison of the Performance of Private, Mixed and Public Enterprises”, *Journal of Law and Economics*, Vol. 32, pp: 1-33.

Boardman, Anthony, Roth Friedman, and Catherine Eckel, (1986), “The Price of Government Ownership: A Study of Domtar Takeover” *Journal of Public Economics*, Vol. 31, pp: 285-296.

Bonin, J. P., Hansan, I., and Watchtel, W., (2005), “Firms Performance, Ownership and Efficiency in Transition Economies”, *Journal of Banking and Finance*, Vol. 29, pp: 31-53.

Bonnaccorsi di Patti, B. and Hardy, D. C., (2005), “Financial Sector Liberalisation, Firm Privatisation and Efficiency: Evidence from Pakistan”, *Journal of Banking and Finance*, Volume 29, Issues 8–9, pp: 2381–2406.

Boone, J., (2008), “A New Way to Measure Competition”. *Economic Journal*, Vol. 118, pp: 1245–1261.

Boubakri, N., and Cosset, J.C. (1998), “The Financial and Operating Performance of Newly Privatized Firms: Evidence from Developing Countries”, *Journal of Finance*, Vol. 53, pp: 1081– 1110.

Boubakri, N., Cosset, J. C., and Guedhami, O. (2008), “Privatization in Developing Countries: Performance and Ownership Effect”, *Development Policy Review*, Vol. 26, pp: 275–308.

Boubakri, N., Cosset, J.C. and Guedhami, O. (2005), "Liberalization, Corporate Governance and the Performance of Newly Privatised Firms", *Journal of Corporate Finance*, Vol. 11, pp: 767-90.

Boussofiane, A, Martin, S., and Parker, D. (1997), "The Impact on Technical Efficiency of the UK Privatization Programme", *Applied Economics*, Vol. 29, pp: 297-310.

Boycko, M., Shleifer, A., and Vishny, R.W. (1993), "A Theory of Privatisation", Harvard University, Working Paper.

Boycko, M., Shleifer, A., and Vishny, R. (1995), "Privatizing Russia", MIT Press, Cambridge MA.

Brown, J.D., Earle, J.S., and Telegdy, A. (2006), "The Productivity Effects of Privatization: Longitudinal Estimates from Hungary, Romania, Russia, and Ukraine", *Journal of Political Economy*, Vol. 114, pp: 61-99.

Cakmak, Eral, H. (1992), "Privatisation and Comparative Efficiency of Public and Private Enterprises in Turkey: The Cement Industry", *Annals of Public and Cooperative Economics*, Vol. 63, No.2, pp: 271-283.

Canhoto, A., (2004), "Portuguese Banking: A Structural Model of Competition in the Deposits Market", *Review of Financial Economics*, Vol. 13, pp: 41 – 63.

Canhoto, A., and Dermine, J., (2003), "A Note on Banking Efficiency in Portugal, New vs Old banks, *Journal of Banking and Finance*, Vol. 27, pp: 2087-2098.

Carvalo, O., and Kasman, A., (2005), "Cost Efficiency in the Latin American and Caribbean Banking Systems", *Int. Financial. Markets, Institions. and Money*, Vol. 15, pp: 55-72.

Caves, Richard E. (1990), "Lessons from Privatisation in Britain: State Enterprises Behaviour, Public Choice and Corporate Governance", *Journal of Economic Behaviour and Organization*, Vol. 13, pp: 143-169.

Caves, Richard, E., and Lurits R. C. (1980), "The Relative Efficiency of Public and Private Firms in a Competitive Environment: The Case of Canadian Railroads", *Journal of Political Economy,* Vol. 88, pp: 958-976.

Cazals C., Florens JP., Simar L. (2002), "Nonparametric Frontier Estimation: a Robust Approach", *Journal of Econometrics*, Vol. 106, Issue 1, pp: 1–25.

Cazals, C., J. P. Florens, and L. Simar (2002), "Nonparametric Frontier Estimation: A Robust Approach", *Journal of Econometrics*, Vol. 106, pp: 1–25.

Çelen, A., and Günalp, B. (2010), "Do Investigations of Competition Authorities Really Increase The Degree of Competition? An Answer from Turkish Cement Market", *Prague Economic Papers,* Issue 2, pp: 150-168.

Çetin *T*amer, Benk Serkan, (2011), "Regulation, Deregulation, and Competition in the Turkish Airline Industry", *The Political Economy of Regulation in Turkey,* pp 193-214.

Chaffai, M. E., (1997), "Estimating Input-specific Technical Inefficiency: The Case of the Tunisian Banking industry", *European Journal of Operational Research*, Vol. 98, Issue 2, pp: 314-331.

Chiang, F. S., Sun, C. H., and Yu, J. M., (2004), "Technical Efficiency Analysis of Milkfish (Chanos Chanos) Production in Taiwan – An Application of the Stochastic Frontier Production Function", *Aquaculture,* Vol. 230, pp: 99-116.

Chirwa, E.W. (2002), "Privatization and Technical Efficiency: Evidence from the Manufacturing Sector in Malawi", *African Development Review*, Vol. 13, Issue 2, pp: 276-307.

Chirwa, E.W. (2004), "Industry and Firm Effects of Privatization in Malawian Oligopolistic Manufacturing", *The Journal of Industrial Economics*, Vol. 52, Issue 2, pp: 277-289.

Chishty, Md. and Shamsul Haque. (1985), "The Experience of Bangladesh" Asian Development Bank (Eds.), Privatisation-Policy, Methods and Procedures (Manila: Asian Development Bank), pp: 261-299.

Christensen, L., Jorgensen, D. and Lau, L., (1971), "Conjugate Duality and the Transcendental Logarithmic Production Function", *Econometrica*, Vol. 39: pp: 255–56.

Christopolous, D. K., Lolos, S. E. G., Tsionas, E. G., (2002), "Efficiency of the Greek Banking System in View of the EMU: a Heteroscedastic Stochastic Frontier Approach, *Journal of Policy Making*, Vol. 24, pp: 813-829.

Claessens, S.,and Djankov, S. (1999), "Ownership Concentration and Corporate Performance in the Czech Republic", *Journal of Comparative Economics*, Vol. 27, pp: 498– 513.

Coccorese, P., (2004), "Banking Competition and Macroeconomic Conditions: A Disaggregate Analysis", *International Financial Markets, Institutions and Money*, Vol. 14, pp: 203 – 219.

Coccorese, P., (2012), "A Stochastic Frontier Estimation of the Lerner Index for the Banking Industry", Memo, Department of Economics and Statistics, and CELPE – University of Salerno, Italy.

Coelli, T.J. (1996), "A Guide to Frontier Version 4.1: "A Computer Program for Stochastic Frontier Production and Cost Function Estimation" CEPA Working Paper 96/07, Centre for Efficiency and Productivity Analysis, University of New England, Armidale, NSW, 2351, Australia.

Coelli, T.J., and Battese, G.E. (1996), "Identification of Factors which Influence the Technical Inefficiency of the Indian Farmers" *Australian Journal of Agricultural Economics*, Vol. 40, No.2, pp: 103-128.

Cooper, W. W., Kumbhakar, S., Thrall, R. M., Yu, X., (1995), "DEA and Stochastic Frontier Analyses of the 1978 Chinese Economic Reforms", *Socio-econ Planning. Science.*, Vol. 29, Issue 2, pp: 85-112.

Cornwell, C., P. Schmidt, and Sickles, R.C. (1990), "Production Frontiers with Cross-Sectional and Time-Series Variation in Efficiency Levels," *Journal of Econometrics*, Vol. 46, pp: 185-200.

Cowan, S., (1997), "Competition in the Water Industry", *Oxford Review of Economic Policy*, Vol. 13, Issue 1, pp: 83 – 92.

Cuesta, R. A., Orea, L., (2002), "Mergers and Technical Efficiency in Spanish Savings Banks: A Stochastic Distance Function Approach", J*ournal of Banking and Finance,* Vol. 26, pp: 2231-2247.

Cullinane, K., and Song, D.W. (2003), "A Stochastic Frontier Model of the Productive Efficiency of Korean Container Terminals", *Applied Economics*, Vol. 35, pp: 251-267.

Cullinane, K., Ji, P., and Wang, T. (2005), "The Relationship Between Privatization and DEA Estimates of Efficiency in the Container Port Industry", *Journal of Economics and Business*, Vol. 57, pp: 433-462.

D"Souza, J., and Megginson, W.L. (1999), "The Financial and Operating Performance of Privatized Firms During the 1990s", *Journal of Finance*, Vol. 54, pp: 1397– 1438.

D'Souza, J., Megginson, W., and Nash, R. (2002), "Determinants of Performance Improvements in Privatized Firms: The Role of Restructuring and Corporate Governance", Working Paper. University of Oklahoma.

Das, D.K.; Kalita, G. and Wadhwa, D. (2009), "The Employment Potential of Labour-intensive Industries: An Appraisal of India's Organised Manufacturing", Working Paper 236, ICRIER, New Delhi.

De Bandt, O. and Davis, E. P., (2000), "Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU", *Journal of Banking and Finance*, Vol. 24, pp: 1045 – 1066.

Denny, M., Fuss, M., Everson, C. and Waverman, L. (1981) "Estimating the Effects of Diffusion of Technological Innovations in Telecommunications: The Production Structure of Bell Canada", *Canadian Journal of Economics*, Vol. 14, Issue 1, pp: 24-43.

Dewenter, K.L., and Malatesta, P.H. (2001), "State-Owned and Privately Owned Firms: An Empirical Analysis of Profitability, Leverage, and Labour Intensity", *American Economic Review*, Vol. 91, pp: 320– 334.

Diewert, W., E., (1974), "Functional Forms for Revenue and Factor Requirement Functions", *International Economic Review*, Vol. 15, Issue 1, pp: 119-130.

Djankov, S., and Murrell, P. (2002), "Enterprise Restructuring in Transition: A Quantitative Survey", *Journal of Economic Literature*, Vol. 40, pp: 739−792.

Douglas G. W., Miller, J. C. (1974), Quality Competition, Industry Equilibrium, and Efficiency in the Price-Constrained Airline Market, *The American Economic Review*, Vol. 64, No. 4, pp: 657-669

El-Gamal, A., and Inanoglu, H., (2005), Inefficiency and Heterogeneity in Turkish Banking: 1990-2002, *Journal of Applied Econometrics*, Vol. 20, Issue 5, pp: 641-664.

Estache, A. Rossi, M. A., (2005), “Do Regulation and Ownership Drive the Efficiency of Electricity Distribution? Evidence From Latin America”, *Economics Letters*, Vol. 86, Issue 2, pp: 253-257.

Estache, A., Marianela, G., and Lourdes, T. (2002), “What Does Privatization Do For Efficiency? Evidence from Argentina’s and Brazil’s Railways”, *World Development*, Vol. 30, pp: 1885-1897.

Ferrari, A. and Guiletti, M, (2005), “Competition in Electricity Markets: International Experience and the Case of Italy”, *Utilities Policy*, Vol. 13, pp: 247-255.

Finance Division, Ministry of Finance, Government of Bangladesh, (2002), Functions of Firms and Financial Institutions, Government of Bangladesh, Dhaka.

Florens, J., Simar, L., (2005), “Parametric Approximations of Nonparametric Frontiers”, *Journal of Econometrics*, Vol. 124, pp: 91-116.

Førsund, F. and L. Hjalmarsson (1983), "Technical Progress and Structural Change in the in the Swedish Cement Industry 1955–1979”, *Econometrica*, Vol.51, Issue 5: pp: 1449–67.

Fuckuyama, H. and Weber, W. L., (1999), “The Efficiency and Productivity of Japanese Securities Firm 1988-93, *Japan and the World Economy*, Vol. 11, pp: 115-133.

Fuckuyama, H. and Weber, W. L., (2002), “Estimating Output Allocative Efficiency and Productivity Change: Application to Japanese Banks”, *European Journal of Operational Research*, Vol. 137, pp: 177-190.

Galal, A, Jones, L.P., Tandon, P., and Vogalsang, I. (1994), "Welfare Consequences of Selling Public Enterprises", The World Bank, Washington D.C.

Garcia del Hoyo, J. J., Espino, D. C., and Toribio, R. J., (2004), "Determination of Technical Efficiency of Fisheries by Stochastic Frontier Models: A Case on the Gulf of Cadiz (Spain)", *Journal of Marine Science*, Vol. 61, pp: 416-421.

Gilbert, R. A., Wilson, P. W., (1998), "Effects of Deregulation on the Productivity of Korean Banks", *Journal of Economics and Business,* Vol. 50, pp: 133-155.

Gjirja, M., (2004), Effects Of Deregulation And Crisis On Labour Use Efficiency In The Swedish Banking Industry, Electronic Publishing Center Economic Studies, pp:136.

Goodman, John, B., and Carry W. L. (1992), "Does Privatisation Serve the Public Interest?", Harvard Business Review, November/December, pp: 26-38.

Government of Pakistan, Economic Advisor Wing, Ministry of Finance. "Economic Survey" (Various issues), Islamabad, Pakistan.

Government of Pakistan, Expert Advisory Cell, Ministry of Production. "Annual Report of Public Enterprises" (Various issues), Islamabad, Pakistan.

Government of Pakistan, Federal Bureau of Statistics (FBS), (1998), "Fifty Years in Pakistan Statistics" Islamabad, Pakistan.

Government of Pakistan, Federal Bureau of Statistics (FBS), "Census of Manufacturing Industries (CMI)" (Various issues), Karachi, Pakistan.

Government of Pakistan, National Development Finance Corporation (NDFC), 1991. "Cement Directory" Karachi, Pakistan.

Government of Pakistan, National Development Finance Corporation (NDFC) (1991), "Cement Directory", Karachi, Pakistan.

Government of Pakistan, State Bank of Pakistan (SBP), "Monthly Statistical Bulletin" (Various issues), Karachi, Pakistan.

Greenaway, D. and Kneller, R. (2007), "Firm Heterogeneity, Exporting and Foreign Direct Investment: A Survey", *The Economic Journal*, Vol. 117, pp: 134–161.

Griffith, R., Boone, J., Harrison, R., (2005), "Measuring Competition. Advanced Institute of Management Research Paper No. 022.

Gruben, W. C. and McComb, R. P., (2003), "Privatisation, Competition and Supercompetition in the Mexican Commercial Banking System", *Journal of Banking and Finance*, Vol. 27, pp: 229 – 249.

Handoussa, H., and G. Potter. (1991), "Employment and Structural Adjustment: Egypt in the 1990s", Cairo: American University in Cairo Press.

Haouras, I., Yagoubi, M., and Heshmati, A. (2003) "Labour Use Efficiency in Tunisian Manufacturing Industries, *Review of Middle East Economics and Finance*, Vol. 1, Issue 3, pp: 195-214.

Hawkins, J. and Mihaljek, D., (2001), "The Banking Industry in the Emerging Market Economies: Competition, Consolidation and Systemic Stability: An Overview", in the Banking Industry in the Emerging Market Economies, Competition, Consolidation and Systemic Stability, BIS Papers, No 4, August.

Heshmanti, A., (2001), "Labour Demand and Efficiency in Swedish Savings Banks", *Applied Financial Economics*, Vol. 11, pp: 423-433.

Heshmanti, A., Kumbakhar, S. C., and Hjalmarsson, L., (1995), "Efficiency of the Swedish Pork Industry: a Farm Level Study Using Rotating Panel Data 1976-1988", *European Journal of Operational Research*, Vol. 80, pp: 519-533.

Heshmati A., Kumbhakar, S.C. (2011a), "Technical Change and Total Factor Productivity Growth: The Case of Chinese Provinces", *Technological Forecasting and Social Change*, Vol. 78, Issue 4, pp: 575-590.

Heshmati, A., (2001), "Labour Demand and Efficiency in Swedish Savings Firms", Applied Financial Economics, Vol. 11, Issue 4, pp: 423-433.

Heshmati, A., and Kumbhakar, S. C., (2011a) "A General Model of Technical Change with an Application to the OECD Countries," IZA Discussion Papers 6004, Institute for the Study of Labor (IZA).

Hitomi, K., (2004), "Efficiency Analysis of Japan's Industry and Manufacturing", Technovation, 24, 741-748

Ho, Chun-Yu, (2010), "Deregulation, Competition and Consumer Welfare in Banking Market: Evidence from Hong Kong". *Journal of Regulatory Economics*, Vol. 37, Issue 1, pp: 70-97.

Hondroyiannis, G., Lolos, S. and Papapetrou, E., (1999), "Assessing Competitive Conditions in The Greek Banking System", *Journal of International Financial Markets, Institutions and Money*, Vol. 9, pp: 377 – 391.

Hooper, P.G., and Hensher, D.A. (1997), "Measuring Total Factor Productivity of Airports An Index Number Approach", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 33, pp: 249-259.

Hüschelrath, K, Veith, T. (2011), "The Impact of Cartelization on Pricing Dynamics", ZEW - Centre for European Economic Research Discussion Paper No. 11-067.

Iqbal, Zafar. (1985), "The Experience of Pakistan" in Asian Development Bank (Eds.), Privatisation-Policy, Methods and Procedures (Manila: Asian Development Bank), pp: 293-318.

Iwata, G. (1974), “Measurement of Conjectural Variations in Oligopoly”, *Econometrica*, Vol. 42, pp: 947-966.

Jaffry, S, Ghulam, Y and Cox, J. (2008) “Labour use efficiency in the Indian and Pakistani Commercial Banks”, *Journal of Asian Economics*, Vol. 19, Issue 3, pp: 259-293.

Jensen, M. (1986), “Agency Costs of Free Cash Flow, Corporate Finance and Takeovers”, *American Economic Review*, Vol. 76, pp: 323-329.

Jiang, C., Yao, S., and Zhang, Z. (2009), “The Effects of Governance Changes on Bank Efficiency in China: A Stochastic Distance Function Approach”, *China Economic Review*, Vol. 20, pp: 717-731.

Jone, Leroy, P. (1981), “Towards a Performance Evaluation Methodology for Public Enterprises” Paper Presented at United Nations Sponsored Conference on Economic Performance of Public Enterprises in Islamabad, Pakistan.

Jones, D.C., and Mygind, N. (2002), “Ownership and Productive Efficiency: Evidence from Estonia”, *Review of Development Economics*, Vol. 6, pp: 284-301.

Jones, Leroy, P. and Pankag Tandon. (1998), “Capacity Building of DMC”s in the Economic Analysis of BOOT Projects” Asian Development Bank: Manila, Philippine.

Just, R. E. and Pope, R. D., (1978), “Stochastic Specification of Production Functions and Economic Implications”, Journal of Econometrics, Vol. 7, Issue 1, pp: 67-86.

Kalirajan, K. P. and M. B. Obward. (1994), “Frontier Production Function: The Stochastic Coefficient Approach”, *Oxford Bulletin of Economics and Statistics*, Vol. 56, pp: 87-96.

Kalirajan, K. P. and Shiji Zhao. (1997), “Did the Technical Efficiency of State Enterprises Improve with the Same Speed in all Provinces in China?”, *Applied Economics*, Vol. 29, pp: 269-277.

Kapstein Ethon V. (1988), “Brazil Continued State Dominance” Raymond Version (Ed.), The Promise of Privatisation (Washington DC: Council on Foreign Relations, pp: 122-148.

Kashani, H. A., (2005), “Regulation and Efficiency: An Empirical Analysis of the United Kingdom Continental Shelf Petroleum Industry”, *Energy Policy*, Vol. 33, pp: 915-925.

Kay, J. A., and Thompson, D. J. (1986), “Privatisation: A Policy in Search of Rationale” *Economic Journal*, Vol. 96, pp:18-38.

Kazmi, S. H., (2002), “Commercial Firms, the New Era of Consolidation, Pakistan Economist, July, pp: 15 – 21.

Kennedy, Peter J. Jr. (1986), “State Shrinking: The Jamaican Experience”, William B. Glade (Ed.), State Shrinking: A Comparative Inquiry into Privatisation (Austin TX: Institute of Latin American Studies, University of Taxas), pp:177-202.

Khan, M. Z., (1998), “Transforming Banking in Pakistan in Rising to the Challenge in Asia: A Study of Financial Markets”, Asia Development Bank Publication, 9, pp: 37 – 70.

Khumbhakar, S. C., (2002), “Specification and Estimation of Production Risk, Risk Preferences and Technical Efficiency”, *American Journal of Agricultural Economics*, Vol. 84, Issue 1, pp: 8-22

Khumbhakar, S. C., Lozano-Vivas, A., Knox-Lovell, C. A., Hasan, I., (2001), “The Effects of Deregulation on the Performance of Financial Institutions: The Case of Spanish Savings Banks”, *Journal of Money, Credit and Banking*, Vol. 33, Issue 1, pp: 101-120.

Koo, Bon-Ho. (1985), "The Experience of the Republic of Korea" in Privatisation-Policy, Methods and Procedures (Eds.), Asian Development Bank, Manila, pp: 193-214.

Kulasekaran, S. and Schaffer, S., (2002), "Cost Efficiency among Credit Card Firms, *Journal of Economics and Business*, Vol. 54, pp: 595-614.

Kumbhakar S and L Hjalmarsson (1995). "Labour-Use Efficiency in Swedish Social Insurance Offices", *Journal of Applied Econometrics,* Vol. 1, pp: 33-47.

Kumbhakar, S. C., (1996), "A Farm-Level Study of Labour Use and Efficiency Wages in Indian Agriculture", *Journal of Econometrics,* Vol. 72, pp: 177-195.

Kumbhakar, S. C., (1997), "Modelling Allocative Efficiency in Translog Cost Function and Cost Share Equations: An Exact Relationship", *Journal of Econometrics,* Vol. 76, pp: 351-356.

Kumbhakar, S. C., (2002), "Decomposition of Technical Change into Input Specific Components: A Factor Augmenting Approach", *Japan and the World Economy,* Vol. 14, pp: 243-264.

Kumbhakar, S. C., Heshmanti, A., Hjaalmarsson, L., (1997), "Temporal Patterns of Technical Efficiency: Results from Competing Models", *International Journal of Industrial Organisation*, Vol. 15, pp: 597-616.

Kumbhakar, S. C., Heshmati, A. and Hjalmarsson, L. (1999), "Parametric Approaches to Productivity Measurement: A Comparison among Alternative Models. *The Scandinavian Journal of Economics*, Vol. 101: pp: 405–424.

Kumbhakar, S. C., Nakamura, S., Heshmanti, A., (2000), "Estimation of Firm Specific Technological Bias, Technological Change and Total Factor Productivity Growth: A Dual Approach", *Econometric Reviews*, Vol. 19, Issue 4, pp: 493-515.

Kumbhakar, S. C., and Sarkar, S., (2003), “Deregulation, Ownership and Productivity Growth in The Banking Industry: Evidence From India”, *Journal of Money, Credit and Banking*, Vol. 35, Issue 3, pp: 403-424.

Kumbhakar, S. C., Tsionas, E. G., (2005), “Measuring Technical and Allocative Efficiency in the Translog Cost System: A Bayesian Approach”, *Journal of Econometrics*, Vol. 126, Issue 2, pp: 355-384.

Kumbhakar, S.C. (2004), Productivity and Technical Change: Measurement and Testing, *Empirical Economics*, Vol. 29, pp: 185-191.

Kumbhakar, S.C., Baardsen S., and Gudbrand, L., (2012), “A New Method for Estimating Market Power with an Application to Norwegian Sawmilling”. *Review of Industrial Organization*, Vol. 40, pp: 109-129.

Laffont, J. and Tirole, J. (1991) “Privatization and Incentives”, *Journal of Law, Economics and Organization*, Vol. 7, pp: 84-105.

Laurin, C., and Bozec, Y. (2001), “Privatization and Productivity Improvement: The Case of Canadian National”, *Transportation Research Part E: Logistics and Transportation Review*, Vol. 37, pp: 355-374.

Lee, Y. H., and P. Schmidt (1993) ‘A Production Frontier Model with Flexible Temporal Variation in Technical Inefficiency.’ In The Measurement of Productive Efficiency: Techniques and Applications, edited by H. Fried, C. A. K. Lovell, and S. Schmidt, Oxford University Press.

Li, W., and Xu, LC. (2004), “The Impact of Privatization and Competition in the Telecommunications Sector around the World”, *Journal of Law and Economics*, Vol. 47, pp: 395-430.

Liefert, W., Lerman, Z., Gardner, B. and Serova, E., (2005), "Agricultural Labour in Russia: Efficiency and Profitability", *Review of Agricultural Economics*, Vol. 27, Issue 3, pp: 412–417.

Loof H. and Heshmanti A., (2002), "Knowledge Capital and Performance Heterogeneity: A Firm Level Innovation Study", *International journal of Production Economics*, Vol. 76, pp: 61-85.

Mahlberg, B, and Url, T. (2010), "Single Market Effects on Productivity in the German Insurance Industry", *Journal of Banking and Finance*, Vol. 34, pp: 1540–1548.

Mairesse J. and Jaumandreu J. (2005) "Panel Data Estimates of the Production Function and the Revenue Function: What Difference Does it Make?" Scandinavian Journal of Economics, Vol. 107, Issue.4, pp: 651-672.

Mamatzakis, E., Staikouras, C. and Koutsomanoli-Fillipaki, N., (2005), "Competition and Concentration in the Banking Sector of the South Eastern European Region", *Emerging Markets Review*, Vol. 6, pp: 192 – 209.

Marshall, Jorge. (1986), "Economic Privatisation: Lessons from the Chilean Experience" in William B. Glade (Ed.), State Shrinking: A Comparative Inquiry into Privatisation (Austin TX: Institute of Latin American Studies, University of Taxas), pp: 101-129.

Martin, S. and Parker, D. (1997) "The Impact of privatisation: ownership and corporate performance in the UK", London: Routledge.

Martin, S., and Parker, D. (1995), "Privatization and Economic Performance throughout the UK Business Cycle", *Managerial and Decision Economics*, Vol. 16, pp: 225– 237.

Maudos ,Joaquín , Solís, Liliana , (2011), "Deregulation, Liberalization and Consolidation of the Mexican Banking System: Effects on Competition". *Journal of International Money and Finance*, Vol. 30 pp: 337–353.

Meeusen, W, and Broeck, J. (1977), "Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error", *International Economic Review*, Vol. 18, pp: 435-444.

Megginson, W. L. and Netter, J. M. (2001), "From State to Market: a Survey of Empirical Studies on Privatisation", *Journal of Economic Literature*, Vol. 39, pp: 321-89.

Megginson, W.L., Nash, R.C. and van Randenborgh, M. (1994) "The Financial and Operating Performance of Newly Privatized Firms: An International Empirical Analysis", *Journal of Finance*, Vol.49, pp: 403-452.

Mehdi, Istaqbal. (1998), "Does Privatisation Deliver: A Case Study of Industrial Units of Pakistan" Paper Presented at Conference on Privatisation in Islamabad, Pakistan.

Mendes, V. and Rebelo, J., (1999), "Productivity Efficiency, Technological Change and Productivity in Portuguese Banking", *Applied Financial Economics*, Vol. 9, Issue 5, pp: 513 – 521.

Molyneux, P., Thornton, J. and Lloyd-Williams, D.M., (1996), "Competition and Market Contestability in Japanese Commercial Banking", *Journal of Economics and Business*, Vol. 48, pp: 33 – 45.

Moore, John. (1992), "British Privatisation: Taking Capitalism to the People" Harvard Business Review (January/February), pp: 115-124.

Naqvi, N.H, and Kemal, A.R. (1991), "The Privatisation of the Public Enterprises in Pakistan", *The Pakistan Development Review*, Vol. 30, pp: 105-144.

Naqvi, N.H, and Kemal, A.R. (1997), "Privatisation Efficiency and Employment in Pakistan", In: How Does Privatisation Work? Essays on Privatisation in Honmy of Professor V.V. Ramanadham, Routledge, 11 New Fetter Lane London EC4P 4EE.

Naqvi, Nawab, Hyder, and A. R. Kemal. (1991), "The Privatisation of the Public Enterprises in Pakistan", *The Pakistan Development Review*, Vol. 30, Issue 2, pp: 105-144.

Newbery, D. and Pollitt, M.G. (1997) "The Restructuring and Privatisation of the CEGB –Was It Worth It?", *Journal of Industrial Economics*, Vol.45, pp:269-304.

Oh, I, L, Jeong-Dong, Heshmati, A, (2008), "Total Factor Productivity in Korean Manufacturing Industries". *Global Economic Review*, Volume: 37 Issue: 1 pp: 23-50.

Okoeguale, K. (2012), Deregulation, Competition and Merger Activity in the U.S. Telecommunications Industry.

Okten, C. and Arin, K. P., (2006), "The Effects of Privatisation on Efficiency: How Does Privatization Work?" *World Development*, Vol. 34, Issue 9, pp: 1537–1556.

Oral, E., Laptali l, Mıstıkoglu, G., (2007), "Competitive Analysis of the Turkish Brick Industry- A Case study for Developing Countries", *Building and Environment*, Vol. 42, Issue 1, pp: 416-423

Oum, T.H., Yan, J., and Yu, C. (2008), "Ownership Forms Matter for Airport Efficiency: A Stochastic Frontier Investigation of Worldwide Airports", *Journal of Urban Economics*, Vol. 64, pp: 422-435.

Parker, D. (1999) "The Performance of BAA Before and After Privatisation: a DEA Study", *Journal of Transport Economics and Policy*, Vol. 33, part 2, pp: 133-145.

Parker, D. and Wu, H.L. (1998), "Privatisation and Performance: a Study of the British Steel Industry under Public and Private Ownership", *Economic Issues*, Vol.3, Issue 2, pp: 31-50.

Perera, S., Skully, M. and Wickramanayake, J., (2006), "Competition and Structure of South Asian Banking: A Revenue Behaviour Approach", *Applied Financial Economics*, Vol. 16, Issue 11, pp: 789 – 801.

Piesse, J., Thirtle, C., (2000), "A Stochastic Frontier Approach to Firm Level Efficiency, Technological Change and Productivity During the Early Transition in Hungary", *Journal of Comparative Economics*, Vol. 28, pp: 473-501.

Pint, E. (1991) "Nationalization vs. Regulation of Monopolies: the Effects of Ownership on Efficiency", *Journal of Public Economics*, Vol. 44, pp: 131-164.

Plane, P. (1999), "Privatization, Technical Efficiency and Welfare Consequences: the Case of the Cote d"Ivoire Electricity Company (CIE)", *World Development*, Vol. 27, pp: 343-360.

Prague Economic Papers, Vol. 2, pp: 150-168.

Prior, D., (2003), "Long and Short Run Non-parametric Cost Frontier Efficiency: an Application to Spanish Savings Banks", *Journal of Banking and Finance*, Vol. 27, pp: 655-671.

Pryke, Richard. (1982), "The Comparative Performance of Public and Private Enterprises", *Fiscal Studies*, Vol. 3, pp: 68-81.

Raghbendra, Jha. (1992), "Measurement of Efficiency in Private and Public Sector Industries: The Case of India", *Annals of Public and Cooperative Economics*, Vol. 63, No.3, pp: 489-507.

Rao, A., (2005), "Cost Frontier Efficiency and Risk-return Analysis in an Emerging Market", *International Review of Financial Analysis*, Vol. 14, Issue 3, pp: 283-303.

Resende, M., and Facanha, L. (2002), "Privatization and Efficiency in Brazilian Telecommunications: an Empirical Study", *Applied Economics Letters*, Vol. 9, pp: 823-826.

Ros, A.J. (1999), "Does Ownership or Competition Matter? The Effects of Telecommunications Reform on Network Expansion and Efficiency", *Journal of Regulatory Economics*, Vol. 15, pp: 65-92.

Rosenbaum, D. I., Sukharomana, S. (2001), Oligopolistic Pricing Over the Deterministic Market Demand Cycle: Some Evidence from the US Portland Cement Industry, *International Journal of Industrial Organization*, Vol. 19, Issue 6, pp: 863-884.

Rossi, M.A. (2001), "Technical Change and Efficiency Measures: the Post Privatisation in the Gas distribution sector in Argentina", *Energy Economics*, Vol. 23, pp: 295-304.

Saal, D.S., and Parker, D. (2000), "The Impact of Privatization and Regulation on the Water and Sewerage Industry in England and Wales: A Translog Cost Function Model", *Managerial and Decision Economics*, Vol. 21, pp: 253-268.

Saal, D.S., and Parker, D. (2001), "Productivity and Price Performance in the Privatized Water and Sewerage Companies of England and Wales", *Journal of Regulatory Economics*, Vol. 20, pp: 61-90.

Saal, D.S., Parker, D., and Weyman-Jones, T. (2007), "Determining the Contribution of Technical Change, Efficiency Change and Scale Change to Productivity Growth in the Privatized English and Welsh Water and Sewerage Industry: 1985–2000", *Journal of Productivity Analysis*, Vol. 28, pp: 127-139.

Salvo, A. (2010), Inferring Market Power under the Threat of Entry: The Case of the Brazilian Cement Industry. *The RAND Journal of Economics*, Vol. 41: pp: 326–350.

Sappington, D.E. and Stiglitz, J.E. (1987) "Privatization, Information and Incentives", *Journal of Policy Analysis and Management*, Vol.6, Issue 4, pp:567-82.

Sarkar, J., Sarkar, S. and Baumik, S. K., (1998), "Does Ownership Always Matter? Evidence from the Indian Banking Sector", *Journal of Comparative Economics*, Vol.26, pp: 262 – 281.

Sayeed, Y., Bari, M., Rahman, M. M., Azad, W. A., Moniruzzaman, M., Shilpi, L. M., (2002), Swinging Banking: Not Very Promising", Bangladesh Research, Asset and Investment Management Services of Bangladesh Limited

Saygili, S., and Taymaz, E. (2001), "Privatization, Ownership and Technical Efficiency a Study of the Turkish Cement Industry", *Annals of Public and Cooperative Economics*, Vol. 72, pp: 581-605.

Schaeck, K., Cihák, M. (forthcoming), "Competition, Efficiency, and Stability in Banking", *Financial Management*, DOI: 10.1111/fima.12010.

Schmidt, Peter. and Lovell C.A.K. (1979), "Estimating Technical and Allocative Inefficiency Relative to Stochastic Production and Cost Frontiers" *Journal of Econometrics*, Vol. 9, pp: 343-366.

Scott, A.E., and Daniel, P. (2002), "Stochastic Estimation of Firm Technology, Inefficiency and Productivity Growth Using Shadow Cost and Distance Functions", *Journal of Econometrics*, Vol. 108, pp: 203-225.

Scully, G.W. (1999), "Reform and Efficiency Gains in the New Zealand Electrical Supply Industry", *Journal of Productivity Analysis*, Vol. 11, pp: 133-147.

Sengupta, J. K., (2004), "The Survivor Technique and the Cost Frontier: A Non-Parametric Approach", *International Journal of Production Economics*, Vol. 87, pp: 185-193

Shaffer, S., (1993), A Test of Competition in Canadian Banking", *Journal of Money, Credit and Banking*, Vol. 25, Issue 1, pp: 49 – 61.

Shaikh, H. A. (1985), "Efficiency in Production Under Private and Public Ownership: Techniques of Measurement and Evidence from Pakistan" Ph.D Dissertation Submitted to the Graduate School, Boston University, USA.

Shephard, R.W. (1970), "Theory of Cost and Production Function", Princeton: Princeton University Press.

Shirley, M., and Walsh, P. (2000), "Public Versus Private Ownership: The Current State of Debate", Policy Research Working Paper, Vol. 2420. Washington D.C.: World Bank.

Shleifer, A. (1998), "State versus Private Ownership", *Journal of Economic Perspectives*, Vol. 12, pp: 133–151.

Sickles, R. C., (2005), "Panel Estimators and the Identification of Firm Specific Efficiency Levels in Parametric, Semi-Parametric and Non-Parametric Settings", *Journal of Econometrics*, Vol. 126, pp: 305-334.

Soderbom, M., Teal, F., (2004), "Size and Efficiency in African Manufacturing Firms: Evidence from Firm-level Panel Data", *Journal of Development Economics*, Vol. 73, pp: 369-394.

Steen, F, Sørgard, L. (1999), Semicollusion in the Norwegian cement market, *European Economic Review*, Vol. 43, Issue 9, pp: 1775-1796.

Sterner, Thomas. (1990), "Ownership, Technology and Efficiency: An Empirical Study of Cooperatives, Multinationals and Domestic Enterprises in the Mexican Cement Industry" *Journal of Cooperative Economics*, Vol. 14, pp: 286-300.

Stevenson, R.E., 1980. Likelihood Functions for Generalized Stochastic Frontier Estimation. *Journal of Econometrics*, Vol. 13, pp: 58-66.

Sun, Q., and Tong, W. (2003), “China Share Issue Privatization: The Extent of its Success”, *Journal of Financial Economics*, Vol. 70, pp: 183–222.

Sunita K. and Perault M. (2010), “Privatization Trends” World Bank Note Number 322, Washington, United States.

The Overseas Economic Cooperation Fund (OECF), (1997), “The Privatisation Policies in Pakistan, Current Situation and Future Challenges” Research Paper No.19, Tokyo, Japan.

Thompson, D.J. (1987), “Privatization in the UK”, *European Economic Review,* Vol. 31, pp: 368– 374.

Tongzon, J., and Heng, W. (2005), “Port Privatization, Efficiency and Competitiveness: Some Empirical Evidence From Container Ports (Terminals)”, *Transportation Research Part A: Policy and Practice,* Vol. 39, pp: 405-424.

Tsekouras, K., and Skouras, D. (2005), “Productive Efficiency and Exports: An Examination of Alternative Hypotheses for the Greek Cement Industry”, *Applied Economics*, Vol. 37, pp: 279-291.

Tveterås, R. Heshmati, A. (2002), “Patterns of Productivity Growth in the Norwegian Salmon Farming Industry”, International Review of Economics and Business, Vol. 3, pp: 367-393.

Vania S. (2006), “The Determinants of Firms’ Performance: Can Finance Constraints Improve Technical Efficiency?”, *European Journal of Operational Research*, Vol. 172, Issue 1, pp: 311-325

Vickers, G., and Yarrow, G. (1991), “Economic Perspectives on Privatization”, *Journal of Economic Perspectives,* Vol. 5, pp: 111-132.

Vickers, J., and Yarrow, G. (1988), “Regulation of Privatized Firms in Britain”, *European Economic Review*, Vol. 32, pp: 465–472.

Villalonga, B. (2000), “Privatization and Efficiency: Differentiating Ownership Effects from Political, Organizational, and Dynamic Effects”, *Journal of Economic Behaviour & Organization*, Vol. 42, pp: 43-74.

Wagner, H., (2004), Internationalisation Speed and Cost Efficiency: Evidence from Germany, International Business Review, *International Business Review*, Vol. 13, pp: 447 – 463.

Wang, C. (2005), “Ownership and Operating Performance of Chinese IPOs”, *Journal of Banking and Finance*, Vol. 29, pp: 1835–1856.

Wei, Z., and Varela, O. (2003), “State Equity Ownership and Firm Market Performance: Evidence from China’s Newly Privatized Firms”, *Global Finance Journal*, Vol. 14, pp: 65–82.

Wheelock D.C., and Wilson, P.W. (2003), “Robust Non-Parametric Estimation of Efficiency and Technical Change in U.S. Commercial Banking”, Working Paper. Federal Reserve Bank of St. Louis. 2003 November.

Wheelock, D. C. and Wilson, P. W., (1999), “Technical Progress, Inefficiency and Productivity Change in U.S. Banking”, 1984 – 1993, *Journal of Money, Credit and Banking*, Vol. 31, pp: 212 – 234.

Wheelock, D.C., and Wilson, P.W. (2001), “New Evidence on Returns to Scale and Product Mix among U.S. Commercial Banks”, *Journal of Monetary Economics*, Vol. 47, pp: 653-674.

Wheelock, D.C., and Wilson, P.W. (2008), “Non-Parametric, Unconditional Quantile Estimation for Efficiency Analysis with an Application to Federal Reserve Check Processing Operations”, *Journal of Econometrics*, Vol. 45, pp: 209-225.

Wheelock, D.C., and Wilson, P.W. (2009), "Robust Nonparametric Quantile Estimation of Efficiency and Productivity Change in U.S. Commercial Banking, 1985–2004", *Journal of Business & Economic Statistics*, Vol. 27, pp: 354-368.

Willner, J. (1996) "A Comment on Bradburd, Privatisation of Natural Monopolies", *Review of Industrial Organization*, Vol. 11, pp: 869-882.

Wonnacott, H. Thomas and Wonnocott Ronald. (1990), "Introductory Statistics for Business and Economics" John Viley & Sons, Inc. USA.

World Bank. (1986), "Capacity Building and Modernization Project of Cement industry", Staff Appraisal Report, Islamabad, Pakistan.

World Bank. (1986), "Capacity Building and Modernization Project of Cement Industry", Staff Appraisal Report, Islamabad, Pakistan.

Wortzel, H. and Wortzel, L. (1989), "Privatization: Not the Only Answer", *World Development*, Vol. 17, pp: 633–641.

Yildirim, H. Semih and Mohanty, Sunil K. (2010), "Geographic Deregulation and Competition in the U.S. Banking Industry. *Financial Markets, Institutions & Instruments*, Vol. 19, Issue 2, pp: 63-94.

Zaim, O., (1995), "The Effect of Financial Reform on the Efficiency of Turkish Commercial Banks, *Applied Financial Economics*, Vol. 5, Issue 4, pp: 257 – 264.

Zaman, Arshad. (1998), "Pakistan: Industry and Trade Sector Study" Consultant Report, Asian Development, Manila, Philippine.

Zeidan R., Resende, M., (2009), Measuring Market Conduct in the Brazilian Cement Industry: A Dynamic Econometric Investigation, *Review of Industrial Organization*, Vol. 34, Issue 3, pp: 231-244.

Zinan, L. and Shaojia G. (1996), "The Efficiency Impact of the Chinese Industrial Reforms in the 1980s", *Journal of Comparative Economics*, Vol. 23, pp: 237-255.